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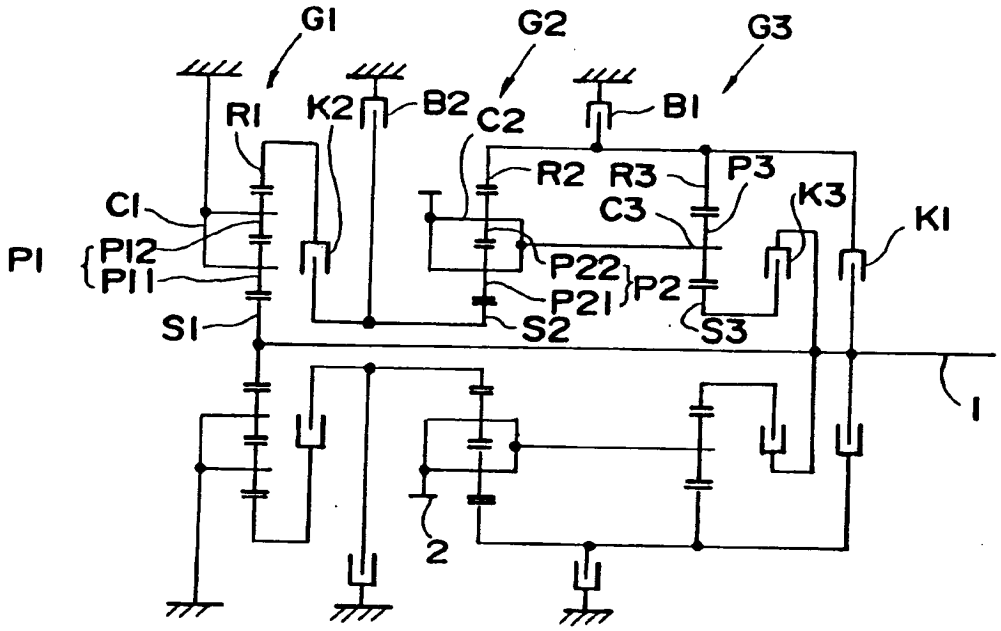
(54) Planetary gear transmission.

(57) A planetary gear transmission typically for use on automobiles has first, second, and third planetary gear trains arranged coaxially with each other and each having elements including a sun gear, a carrier, and a ring gear. Two of the elements of each of the first, second, and third planetary gear trains are directly or disengageably coupled to elements of the other planetary gear trains. The transmission also has three clutch means and two brake means for selectively establishing a power transmitting path from an input shaft to an output gear member through the first, second, and third planetary gear trains. At least one of the first, second, and third planetary gear trains comprises a double-pinion planetary gear train, one of the sun gear and the carrier of the double-pinion planetary gear train being coupled to the input shaft and the other being nonrotatably fixed. The elements of the first, second, and third planetary gear trains are corotatably coupled into first, second, third, fourth, and fifth rotational members in a speed diagram, the third and fifth rotatable members being coupled to the input member, the fourth rotational member being coupled to the output member. The carrier of the double-pinion planetary gear train may be coupled to the input shaft, and the sun gear thereof may be nonrotatably fixed.

EP 0 475 410 A2

Fig. 1


G1
G2
G3
R1
K2
B2
C2
B1
R2
R3
P3
K3
C3
K1
C1
P1
P12
P11
P22
P21
P2
S1
S2
S3
I
2

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to a planetary gear transmission which comprises three planetary gear trains with two elements of each of the planetary gear trains being directly or disengageably coupled to elements of the other planetary gear trains.

Description of the Prior Art:

Planetary gear transmissions are widely used as automatic transmissions for automobiles or the like. Many conventional planetary gear transmissions comprise two planetary gears such as Ravigneaux gear trains, Simpson gear trains, or the like which are combined with each other, and generally have gear positions up to a fourth forward gear position. To meet demands for more gear positions for improved running characteristics, there have been proposed transmissions having gear positions up to and more than a fifth forward gear position, and some of those proposed transmissions have already been in use.

Transmissions with an increased number of gear positions are disclosed in Japanese Laid-Open Patent Publication No. 63-318349 and Japanese Laid-Open Utility Model Publication No. 61-103654, for example. The disclosed transmissions comprise two planetary gear trains each combined with three clutches and three brakes, and have six forward gear positions and one reverse gear position. Since only two planetary gear trains are employed, the disclosed transmissions may share components with conventional planetary gear transmissions. However, the disclosed transmissions are complex in transmission control because they cannot avoid gearshifts which require two engaging means (a clutch and a brake) to be disengaged and two other engaging means to be engaged at the same time.

For example, when the disclosed transmissions effect a gearshift from the second gear position to the third gear position or a gearshift from the third gear position to the second gear position, it is necessary for the transmission to disengage one clutch and one brake and also to engage another clutch and another brake.

Japanese Laid-Open Patent Publications Nos. 59-222644, 1-320361, and 1-320362, for example, disclose planetary gear transmissions each having three planetary gear trains. In the disclosed planetary gear transmissions, two elements of each planetary gear train are mechanically coupled to elements of the other planetary gear trains, and three or four clutches and three brakes are combined with the planetary gear trains. The disclosed planetary gear transmissions have five forward gear positions and one reverse gear position which can be selected by controlling the operation of the engaging means (i.e., the clutches and the brakes). More specifically, each of the gear positions can be selected by engaging two of the engaging means, and any gearshifts between adjacent ones of the five forward gear positions can be accomplished by disengaging one engaging means and engaging another engaging means. Therefore, controlling the disclosed planetary gear transmissions is relatively simple.

However, the planetary gear transmissions each with three planetary gear trains require many engaging means, i.e., six or seven engaging means, in order to establish the desired gear positions. Use of the many engaging means results in a greater transmission size and a more complex transmission structure, and reduces the power transmitting efficiency of the transmissions due to the resistance presented to rotation by the engaging means. Another problem with the above planetary gear transmissions is that a planetary pinion supported on a carrier rotates at a considerably higher speed than an input member (e.g., at a speed which is five or six times the speed of the input member) in certain gear positions (e.g., LOW and 2ND ranges), and the planetary pinion may not sufficiently be lubricated.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a planetary gear transmission with three planetary gear trains which is capable of establishing an increased number of gear positions.

Another object of the present invention is to provide a planetary gear transmission which can effect a gearshift between two adjacent gear positions by disengaging one engaging means (a clutch or a brake) and engaging another engaging means, for thereby easily controlling gearshifts.

Still another object of the present invention is to provide a planetary gear transmission which has a reduced number of engaging means (clutches and brakes) for establishing gear positions, so that the planetary gear transmission is relatively small in size, simple in structure, and has a relatively high power transmitting efficiency.

A further object of the present invention is to provide a planetary gear transmission with three planetary gear trains whose planetary pinions are not rotated at excessively high speed.

According to the present invention, there is provided a planetary gear transmission comprising an input member, first, second, and third planetary gear trains arranged coaxially with each other and

each having elements including a sun gear, a carrier, and a ring gear, two of the elements of each of the first, second, and third planetary gear trains being directly or disengageably coupled to elements of the other planetary gear trains, an output member, and three clutch means and two brake means for selectively establishing a power transmitting path from the input member to the output member through the first, second, and third planetary gear trains, at least one of the first, second, and third planetary gear trains comprising a double-pinion planetary gear train, the sun gear of the double-pinion planetary gear train being coupled to the input member and the carrier being nonrotatably fixed, the elements of the first, second, and third planetary gear trains being corotatably coupled into first, second, third, fourth, and fifth rotational members in a speed diagram, the third and fifth rotatable members being coupled to the input member, the fourth rotational member being coupled to the output member.

The carrier of the double-pinion planetary gear train may be coupled to the input member, and the sun gear thereof may be nonrotatably fixed.

Since only the five engaging means, i.e., the three clutch means and the two brake means, are employed in the above planetary gear transmission, the number of engaging means required is smaller than the number of engaging means in the conventional planetary gear transmission which comprises three planetary gear trains. Therefore, any loss in the transmitted power due to the frictional resistance caused by the engaging means is relatively small, and hence the power transmitting efficiency of the transmission as a whole is improved.

The planetary gear train coupled to the input member may comprise a double-pinion planetary gear train, and the sun gear of the double-pinion planetary gear train may be coupled to the input member and the carrier thereof may be nonrotatably fixed. With this arrangement, the pinion of the double-pinion planetary gear train is prevented from rotating at an excessively high speed. The carrier of the double-pinion planetary gear train may be coupled to the input member and the sun gear thereof may be nonrotatably fixed. This arrangement is also effective to prevent the pinion from rotating at an excessively high speed.

The above and other objects, features, and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings which illustrate preferred embodiments of the present invention by way of example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram showing a skeleton of a planetary gear transmission according to a first embodiment of the present invention;

FIG. 2 is a table showing the relationship between gear ranges, engagement of engaging means, and speed reduction ratios of the planetary gear transmission shown in FIG. 2;

FIGS. 3, 5, and 6A through 6D are diagrams showing rotational speeds of elements of the planetary gear transmission shown in FIG. 2;

FIG. 4 is a table showing how elements are coupled into rotational members in the planetary gear transmission shown in FIG. 2;

FIGS. 7, 11, 13, 17, and 19 are diagrams showing skeletons of planetary gear transmissions according to second through sixth embodiments, respectively, of the present invention;

FIGS. 8, 14, and 20 are tables showing the relationship between gear ranges, engagement of engaging means, and speed reduction ratios of the planetary gear transmissions shown in FIGS. 7, 13, and 19, respectively;

FIGS. 9, 15, and 21 are are diagrams showing rotational speeds of elements of the planetary gear transmissions shown in FIGS. 7, 13, and 19, respectively;

FIGS. 10, 12, 16, 18, and 22 are tables how elements are coupled into rotational members in the planetary gear transmissions shown in FIGS. 7, 11, 13, 17, and 19, respectively;

FIGS. 23 - 116 are diagrams showing skeletons of planetary gear transmissions according to seventh through eleventh embodiments, respectively, of the present invention; and tables showing how elements are coupled into rotational members in the planetary gear transmissions.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Like or corresponding reference characters denote like or corresponding parts throughout views.

FIG. 1 shows a skeleton of a planetary gear transmission according to a first embodiment of the present invention. The planetary gear transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other. The first, second, and third planetary gear trains G1, G2, G3 have respective first, second, and third sun gears S1, S2, S3 which are positioned centrally, respective first, second, and third planetary pinions P1, P2, P3 held in mesh with the first, second, and third sun gears S1, S2, S3, respectively, and rotatable therearound while rotating about their own axes, respective first, second, and third carriers C1, C2, C3 on which the respective first, second, and third planetary pinions P1, P2, P3 are rotatably supported and which are

rotatable therewith around the first, second, and third sun gears S1, S2, S3, respectively, and respective first, second, and third ring gears R1, R2, R3 comprising internal gears meshing with the respective first, second, and third planetary pinions P1, P2, P3. The first and second planetary gear trains G1, G2 comprise double-pinion planetary gear trains, respectively. Specifically, the first pinion P1 comprises two pinion gears P11, P12 and the second pinion P2 comprises two pinion gears P21, P22.

The first sun gear S1 is securely connected to an input shaft 1 for rotation therewith at all times, and the first carrier C1 is nonrotatably fixed to a stationary member. The first ring gear R1 is connected to the second sun gear S2 through a second clutch K2. The second sun gear S2 can be held against rotation by a second brake B2. The second carrier C2 is directly coupled to the third carrier C3, and is also connected to an output gear 2. Therefore, rotation of the second and third carriers C2, C3 is picked up as output rotation of the planetary gear transmission. The second ring gear R2 is directly coupled to the third ring gear R3, and these ring gears R2, R3 can be held together against rotation by a first brake B1. The second and third ring gears R2, R3 are disengageably connected to the input shaft 1 through a first clutch K1. The third sun gear S3 is also disengageably connected to the input shaft 1 through a third clutch K3.

In the planetary gear transmission of the above structure, gear positions can be established and gearshifts can be controlled by controlling engagement and disengagement of the first, second, and third clutches K1, K2, K3 and the first and second brakes B1, B2. More specifically, five forward gear positions or ranges (LOW, 2ND, 3RD, 4TH, and 5TH) and one reverse gear position (REV) can be established by engaging and disengaging the first, second, and third clutches K1, K2, K3 and the first and second brakes B1, B2, as shown in FIG. 2. Speed reduction ratios in the respective gear ranges vary depending on the number of teeth of each of the gears, but are shown by way of illustrative example in FIG. 2.

The table of FIG. 2 shows that each of the five forward gear positions or ranges (LOW ~ 5TH) can be established by engaging two of the clutches and brakes (which will also be referred to as "engaging means"). Any gearshifts between adjacent gear positions can be achieved by disengaging one of the two engaging means and engaging the other engaging means, but not disengaging or engaging the two engaging means simultaneously. Therefore, the gearshifts can easily be controlled.

The relationship between rotational speeds of the elements of the planetary gear transmission is shown in FIG. 3.

In FIG. 3, the first, second, and third planetary gear trains G1, G2, G3 are plotted separately from each other. In each of the plotted planetary gear trains G1, G2, G3, each vertical line represents one element of the planetary gear train, and the length thereof represents the rotational speed of the element. The distances between the vertical lines are proportional to the reciprocal of the number of teeth of the sun gears and the reciprocal of the number of teeth of the ring gears.

For example, the three vertical lines (FIG. 3) of the third planetary gear train G3 correspond, successively from the right to the left, to the third sun gear S3, the third carrier C3, and the third ring gear R3, respectively. The upward length of each of the vertical lines represents the rotational speed n in the forward direction. The distance "a" between the vertical line indicating the third sun gear S3 and the vertical line indicating the third carrier C3 corresponds to the reciprocal (1/Zs) of the number Zs of teeth of the third sun gear S3. The distance "b" between the vertical line indicating the third carrier C3 and the vertical line indicating the third ring gear R3 corresponds to the reciprocal (1/Zr) of the number Zr of teeth of the third ring gear R3. Therefore, when the third clutch K3 is engaged to rotate the third sun gear S3 at the same speed n as the rotational speed of the input shaft 1, and the third ring gear R3 is held against rotation by the first brake B1, the rotational speed of the third carrier C3 is indicated by n_c (FIG. 3) indicated by a point of intersection between the vertical line corresponding to the third carrier C3 and a line C which interconnects points A, B, the point A representing the rotation of the third sun gear S3 at the speed n and the point B representing the braked condition of the third ring gear R3.

The first and second planetary gear trains G1, G2 are defined basically in the same manner as described above. However, since the first and second planetary gear trains G1, G2 are double-pinion planetary gear trains, their ring gears rotate with respect to the sun gear in a direction opposite to the direction in which the ring gear of a single-pinion planetary gear train rotates. In FIG. 3, the vertical lines indicative of the sun gear S3 and the ring gear R3 of the third planetary gear train G3 which is a single-pinion planetary gear train are positioned one on each side of the vertical line indicative of the carrier C3 thereof. In the first and second planetary gear trains G1, G2 which are double-pinion planetary gear trains, the vertical lines indicative of the sun gears S1, S2 and the ring gears R1, R2 are positioned on one side of the vertical lines indicative of the carriers C1, C2. The definition of the distances between the vertical lines is the same as described above, i.e., the distances

are proportional to the reciprocal of the number of teeth of the sun and ring gears.

FIG. 4 shows how the elements (the sun gears, the carriers, and the ring gears) shown in FIG. 3 are coupled into rotational members. The first carrier C1 singly serves as a first rotational member, and the first ring gear R1 and the second sun gear S2 can be coupled to each other and jointly serve as a second rotational member. The second ring gear R2 and the third ring gear R3 can be coupled to each other and jointly serve as a third rotational member, and the second carrier C2 and the third carrier C3 can be coupled to each other and jointly serve as a fourth rotational member. The first sun gear S1 and the third sun gear S3 can be coupled to each other and jointly serve as a fifth rotational member. As can be understood from FIGS. 3 and 4, the third and fifth rotational members are directly or disengageably coupled to the input shaft 1, and the fourth rotational member is coupled to the output gear 2.

Furthermore, in all of subsequent embodiments, the third and fifth rotational members are directly or disengageably coupled to the input shaft 1, and the fourth rotational member is coupled to the output gear 2.

FIG. 4 also illustrates ratios λ between the number Zs of teeth of the sun gears and the number Zr of teeth of ring gears (λ = Zs/Zr). The ratio indicates the sizes of the sun gear and the ring gear, and also the size of the planetary pinion between the sun and ring gears. In order for a planetary gear train to be physically established, the ratio λ should be approximately in the range of from 0.3 to 0.6.

The ratio of the rotational speed of the output gear 2 to the rotational speed of the input shaft 1, i.e., a speed reduction ratio, in each of the gear ranges will be determined using a speed diagram.

In the planetary gear transmission of this embodiment, irrespective of which gear range is selected, the first sun gear S1 of the first planetary gear train G1 is fixedly coupled to the input shaft 1 and rotates at the same speed n as the speed of the input shaft 1, and the first carrier C1 is fixed to the stationary member. Therefore, the first ring gear R1 rotates at a speed no (FIG. 5) indicated by a point of intersection between the vertical line indicative of the first ring gear R1 and a dotted straight line Lo between points indicating, respectively, the rotation of the first sun gear S1 and the fixed condition of the carrier C1. The first ring gear R1 always rotates at the speed no irrespective of which gear range is selected.

In the LOW speed range (gear position), the third clutch K3 and the first brake B1 are engaged. Since the ring gears R2, R3 are mechanically coupled to each other and the carriers C2, C3 are mechanically coupled to each other, the second and third planetary gear trains G2, G3 are integrally coupled to each other as a unitary planetary gear train, and may be plotted together as shown in FIG. 5. Because the second clutch K2 is disengaged, the first planetary gear train G1 is separate from the second and third planetary gear trains G2, G3, with only one element (i.e., the first sun gear S1) of the first planetary gear train G1 being coupled to the second and third planetary gear trains G2, G3.

If the input shaft 1 rotates at a speed n, then the third sun gear S3 coupled to the input shaft 1 also rotates at the speed n. Since the second and third ring rings R2, R3 are held against rotation by the first brake B1, the output gear 2 coupled to the carriers C2, C3 rotates at a speed n1 indicated by a point of intersection between the vertical line indicative of these carriers C2, C3 and a dotted straight line L1 interconnecting points which indicate, respectively, the rotation of the third sun gear S3 and the braked condition of the second and third ring gears R2, R3.

According to the conventional planetary gear transmission, the second clutch K2 is dispensed with, and the first ring gear R1 and the second sun gear S2 are directly coupled to each other, and the first, second, and third planetary gear trains are plotted together as indicated by the two-dot-and-dash lines in FIG. 5. In the conventional arrangement, therefore, the first carrier C1 rotates at a speed n11 indicated by a point of intersection between an extension (indicated by a two-dot-and-dash line) of the straight line L1 and the vertical line indicative of the first carrier C1, the first carrier C1 rotating in a direction opposite to the direction in which the first sun gear S1 rotates. The first pinion P1 (i.e., the pinion gears P11, P12) rotatably supported on the carrier C1 thus rotates at an excessively high speed, and cannot sufficiently be lubricated. Specifically, with the speed reduction ratios selected as shown in FIG. 2, the rotational speed of the first pinion is about six times the rotational speed n of the input shaft 1.

According to this embodiment, however, since the first carrier C1 is fixed to the stationary member, the rotational speed of the first pinion P1 is much lower, e.g., about 2.0 times the rotational speed n of the input shaft 1 with the speed reduction ratios selected as shown in FIG. 2. Consequently, the first pinion P1 is almost free of the problem of insufficient lubrication. Particularly, the first pinion P1 can easily be supplied with lubricating oil because the first carrier C1 on which the first pinion P1 is rotatably supported is fixed in position.

In the 2ND speed range (gear position), the third clutch K3 remains engaged, the first brake B1 is disengaged, and the second brake B2 is en-

gaged. The third sun gear S3 rotates at the same speed n as the rotational speed of the input shaft 1, and the second sun gear S2 is held against rotation. At this time, the output gear 2 coupled to the carriers C2, C3 rotates at a speed n2 indicated by a point of intersection between the vertical line indicative of the second and third carriers C2, C3 and a dotted straight line L2 between points which indicate, respectively, the rotation of the third sun gear S3 and the braked condition of the second sun gear S2.

In the speed 3RD range (gear position), the third clutch K3 remains engaged, the second brake B2 is disengaged, and the second clutch K2 is engaged. The third sun gear S3 rotates at the same speed n as the rotational speed of the input shaft 1, and the second sun gear S2 rotates at the same speed no as the rotational speed of the first ring gear R1 because the second sun gear S2 is coupled to the first ring gear R1 by the second clutch K2. At this time, the output gear 2 coupled to the carriers C2, C3 rotates at a speed n3 indicated by a point of intersection between the vertical line indicative of the second and third carriers C2, C3 and a dotted straight line L3 between points which indicate, respectively, the rotation of the third sun gear S3 and the rotation of the second sun gear S2.

In the 4TH speed range (gear position), the third clutch K3 remains engaged, and the second clutch K2 is disengaged and the first clutch K1 is engaged. The first, second, and third planetary gear trains G1, G2, G3 rotate together with the input shaft 1. The third sun gear S3, the second and third ring gears R2, R3 rotate at the same speed n as the rotational speed of the input shaft 1. At this time, the output gear 2 coupled to the carriers C2, C3 rotates at a speed n4 (= n) indicated by a point of intersection between the vertical line indicative of the second and third carriers C2, C3 and a horizontal solid straight line L4.

In the 5TH speed range (gear position), the first clutch K1 remains engaged, the third clutch K3 is disengaged, and the second clutch K2 is engaged. The second and third ring gears R2, R3 rotate at the same speed n as the rotational speed of the input shaft 1. Since the second sun gear S2 is coupled to the first ring gear R1 by the second clutch K2, the first sun gear S2 rotates at the same speed no as the rotational speed of the first ring gear R1. At this time, the output gear 2 coupled to the carriers C2, C3 rotates at a speed n5 indicated by a point of intersection between the vertical line indicative of the second and third carriers C2, C3 and a dotted straight line L5 connecting points which indicate, respectively, the rotation of the ring gears R2, R3 and the rotation of the second sun gear S2.

In the REV speed range (gear position), the second clutch K2 is engaged, and the first brake B1 is engaged. Since the second sun gear S2 is coupled to the first ring gear R1 by the second clutch K2, the first sun gear S2 rotates at the same speed no as the rotational speed of the first ring gear R1. The second and third ring gears R2, R3 are held against rotation by the first brake B1. At this time, the output gear 2 coupled to the carriers C2, C3 rotates at a speed nR indicated by a point of intersection between the vertical line indicative of the second and third carriers C2, C3 and a dotted straight line LR connecting points which indicate, respectively, the braked condition of the ring gears R2, R3 and the rotation of the second sun gear S2.

The rotational speeds of the output gear 2 with respect to the rotational speed n of the input shaft 1 in the respective gear positions or ranges can be determined in the manner described above. The rotational speeds thus determined are shown altogether in FIG. 6A. In FIG. 6A, five vertical lines ① ~ ⑤ represent the first through fifth rotational members, respectively, and the distances d_1 ~ d_4 between the vertical lines are uniquely determined once the speed reduction ratios in the gear positions or ranges are given. For example, if the speed reduction ratios are given as shown in FIG. 2, the distances d_1 ~ d_4 between the vertical lines are indicated as follows:

$$d_1 : d_2 : d_3 : d_4 = 455 : 111 : 149 : 286.$$

The first planetary gear train G1 is composed of the first rotational member ① , the second rotational member ② , and the fifth rotational member ⑤ . If the first planetary gear train G1 comprised a single-pinion planetary gear train, then the first rotational member ① . would be a ring gear, the second rotational member ② would be a carrier, and the fifth rotational member ⑤ would be a sun gear, as shown in FIG. 6B. The distances a_1, b_1 between the vertical lines, corresponding to the reciprocals of the numbers of teeth of the sun and ring gears, would be given by:

$$a_1 : b_1 = 455 : 546$$

from the distances d_1 ~ d_4 between the vertical lines shown in FIG. 6A. At this time, the ratio λ between the numbers of teeth of the sun and ring gears would be $\lambda = 0.833$. Since this value of the ratio is not in conformity with the condition in which the planetary gear train can be physically established, i.e., the numerical range of $0.3 < \lambda < 0.6$, it is not possible to employ a single-pinion planetary gear train as the first planetary gear train G1 in this embodiment.

Now, it is assumed that the the first planetary gear train G1 comprises a double-pinion planetary gear train as with the illustrated embodiment. In this case, the first rotational member ① would be a carrier, the second rotational member ② would be a ring gear, and the fifth rotational member ⑤ would be a sun gear, as shown in FIG. 6C. The distances a_2, b_2 between the vertical lines, corresponding to the reciprocals of the numbers of teeth of the sun and ring gears, are given by:

$$a_2 : b_2 = 1000 : 455$$

from the distances d_1 ~ d_4 between the vertical lines shown in FIG. 6A. At this time, the ratio λ between the numbers of teeth of the sun and ring gears is $\lambda = 0.455$. This value of the ratio is in conformity with the condition in which the planetary gear train can be physically established, i.e., the numerical range of $0.3 < \lambda < 0.6$. Therefore, the first planetary gear train G1 must be a double-pinion planetary gear train.

The first planetary gear train G1 may be a double-pinion planetary gear train with the first rotational member ① as a sun gear, the second rotational member ② as a ring gear, and the fifth rotational member ⑤ as a carrier, as shown in FIG. 6D. The distances a3, b3 between the vertical lines, corresponding to the reciprocals of the numbers of teeth of the sun and ring gears, are given by:

$$a_3 : b_3 = 1000 : 545$$

from the distances d_1 ~ d_4 between the vertical lines shown in FIG. 6A. At this time, the ratio λ between the numbers of teeth of the sun and ring gears is $\lambda = 0.545$. This value of the ratio is also in conformity with the condition in which the planetary gear train can be physically established, i.e., the numerical range of $0.3 < \lambda < 0.6$.

Other embodiment according to the present invention will be described hereinafter.

FIG. 7 shows a skeleton of a planetary gear transmission according to a second embodiment of the present invention. In the second embodiment and other subsequent embodiments, only an upper half of the skeleton of the planetary gear transmission, above the central axis about which the elements are rotatable, is shown for the sake of brevity. As shown in FIG. 7, the The planetary gear transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other. The first and second planetary gear trains G1, G2 comprise double-pinion planetary gear trains, respectively, and the third planetary gear train G3 comprises a single-pinion planetary gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1 for rotation therewith at all times, as shown in FIG. 6D. The first ring gear R1 is connected to the second sun gear S2 through the second clutch K2. The second sun gear S2 can be held against rotation by the second brake B2, and is coupled to the third ring gear R3 by the third clutch K3. The second carrier C2 is directly coupled to the output gear 2. The second ring gear R2 is directly coupled to the third carrier C3, and the second ring gear R2 and the third carrier C3 can be held together against rotation by the first brake B1. The second ring gear R2 and the third carrier C3 are disengageably connected to the input shaft 1 through the first clutch K1. The third sun gear S3 is securely connected to the input shaft 1.

In the planetary gear transmission shown in FIG. 7, five forward and one reverse gear positions or ranges can be established by controlling engagement and disengagement of the first, second, and third clutches K1, K2, K3 and the first and second brakes B1, B2, as shown in FIG. 8.

The relationship between rotational speeds of the elements of the planetary gear transmission shown in FIG. 7 is shown in FIG. 9. FIG. 10 shows how the elements are coupled into rotational members in the planetary gear transmission shown in FIG. 7. In this embodiment, the first sun gear S1 singly serves as a first rotational member, and the first ring gear R1, the second sun gear S2, and the third ring gear R3 are coupled to each other and jointly serve as a second rotational member. The second ring gear R2 and the third carrier C3 are coupled to each other and jointly serve as a third rotational member, and the second carrier C2 singly serves as a fourth rotational member. The first carrier C1 and the third sun gear S3 are coupled to each other and jointly serve as a fifth rotational member. The third and fifth rotational members are coupled to the input shaft 1, and the fourth rotational member is coupled to the output gear 2.

As described above with reference to FIGS. 6A through 6D, the first planetary gear train G1 comprises a double-pinion planetary gear train because it satisfies the condition required for planetary gear trains to be physically established. Since the first sun gear S1 is nonrotatably fixed in position at all times and the first carrier C1 is securely coupled to the input shaft 1 for rotation therewith at all times, the first ring gear R1 rotates in the same direction and at the same speed no as the input shaft 1 irrespective of which gear position or range is selected. Consequently, the first pinion P1 is prevented from rotating at an excessively high speed. Specifically, with the speed reduction ratios selected as shown in FIG. 8, the rotational speed of

the first pinion P1 is about 2.5 times the rotational speed n of the input shaft 1.

In the second embodiment, the speed reduction ratios in the respective gear positions or ranges may also be determined using a speed diagram in the same manner as described above with reference to the first embodiment.

FIG. 11 shows a skeleton of a planetary gear transmission according to a third embodiment of the present invention. The planetary gear transmission shown in FIG. 11 differs from the planetary gear transmission shown in FIG. 7 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1 for rotation therewith at all times, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the planetary gear transmission shown in FIG. 11 are identical to those of the planetary gear transmission shown in FIG. 7.

As shown in FIG. 12, the first carrier C1 serves as a first rotational member and the first sun gear S1 and the third sun gear S3 serve as a fifth rotational member in the planetary gear transmission shown in FIG. 11. Although the speed diagram of the first planetary gear train G1 of the planetary gear transmission according to the second embodiment corresponds to FIG. 6D, the speed diagram of the first planetary gear train G1 of the planetary gear transmission according to the third embodiment corresponds to FIG. 6C.

FIG. 13 shows a skeleton of a planetary gear transmission according to a fourth embodiment of the present invention. As shown in FIG. 13, the planetary gear transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other. The first and second planetary gear trains G1, G2 comprise double-pinion planetary gear trains, respectively, and the third planetary gear train G3 comprises a single-pinion planetary gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1 for rotation therewith at all times, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. The first ring gear R1 is connected to the second carrier C2 through the second clutch K2. The second carrier C2 can be held against rotation by the second brake B2, and is coupled to the third ring gear R3 by the third clutch K3. The second sun gear S2 is directly coupled to the output gear 2. The second ring gear R2 is directly coupled to the third carrier C3, and the second ring gear R2 and the third carrier C3 can be held together against rotation by the first brake B1. The second ring gear R2 and the third carrier C3 are disengageably connected to the input shaft 1 through the first clutch K1. The third sun gear S3 is securely connected to the input shaft 1.

In the planetary gear transmission shown in FIG. 13, five forward and one reverse gear positions or ranges can be established by controlling engagement and disengagement of the first, second, and third clutches K1, K2, K3 and the first and second brakes B1, B2, as shown in FIG. 14.

The relationship between rotational speeds of the elements of the planetary gear transmission shown in FIG. 13 is shown in FIG. 15. FIG. 16 shows how the elements are coupled into rotational members in the planetary gear transmission shown in FIG. 13. In this embodiment, the first sun gear S1 singly serves as a first rotational member, and the first ring gear R1, the second carrier C2, and the third ring gear R3 are coupled to each other and jointly serve as a second rotational member. The second ring gear R2 and the third carrier C3 are coupled to each other and jointly serve as a third rotational member, and the second sun gear S2 singly serves as a fourth rotational member. The first carrier C1 and the third sun gear S3 are coupled to each other and jointly serve as a fifth rotational member.

FIG. 17 shows a skeleton of a planetary gear transmission according to a fifth embodiment of the present invention. The planetary gear transmission shown in FIG. 17 differs from the planetary gear transmission shown in FIG. 13 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1 for rotation therewith at all times, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the planetary gear transmission shown in FIG. 17 are identical to those of the planetary gear transmission shown in FIG. 13.

As shown in FIG. 18, the first carrier C1 serves as a first rotational member and the first sun gear S1 and the third sun gear S3 serve as a fifth rotational member in the planetary gear transmission shown in FIG. 17. The speed diagram of the first planetary gear train G1 of the planetary gear transmission according to the fifth embodiment corresponds to FIG. 6C.

FIG. 19 shows a skeleton of a planetary gear transmission according to a sixth embodiment of the present invention. As shown in FIG. 19, the planetary gear transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other. All of the first, second, and third planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1 for rotation therewith at all times, with the first planetary gear

train G1 being of a structure as shown in FIG. 6D. The first ring gear R1 is connected to the second sun gear S2 through the second clutch K2. The second sun gear S2 can be held against rotation by the second brake B2, and is coupled to the third carrier C3 by the third clutch K3. The second carrier C2 is directly coupled to the output gear 2. The second ring gear R2 is directly coupled to the third ring gear R3, and the second and third ring gears R2, R3 can be held together against rotation by the first brake B1. The second and third ring gears R2, R3 are disengageably connected to the input shaft 1 through the first clutch K1. The third sun gear S3 is securely connected to the input shaft 1.

In the planetary gear transmission shown in FIG. 19, five forward and one reverse gear positions or ranges can be established by controlling engagement and disengagement of the first, second, and third clutches K1, K2, K3 and the first and second brakes B1, B2, as shown in FIG. 20.

The relationship between rotational speeds of the elements of the planetary gear transmission shown in FIG. 19 is shown in FIG. 21. FIG. 22 shows how the elements are coupled into rotational members in the planetary gear transmission shown in FIG. 19. In this embodiment, the first sun gear S1 singly serves as a first rotational member, and the first ring gear R1, the second sun gear S2, and the third carrier C3 are coupled to each other and jointly serve as a second rotational member. The second ring gear R2 and the third ring gear R3 are coupled to each other and jointly serve as a third rotational member, and the second carrier C2 singly serves as a fourth rotational member. The first carrier C1 and the third sun gear S3 are coupled to each other and jointly serve as a fifth rotational member.

FIG. 23 shows a skeleton of a planetary gear transmission according to a seventh embodiment of the present invention. The planetary gear transmission shown in FIG. 23 differs from the planetary gear transmission shown in FIG. 19 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1 for rotation therewith at all times, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the planetary gear transmission shown in FIG. 23 are identical to those of the planetary gear transmission shown in FIG. 19.

As shown in FIG. 24, the first carrier C1 serves as a first rotational member and the first sun gear S1 and the third sun gear S3 serve as a fifth rotational member in the planetary gear transmission shown in FIG. 23. The speed diagram of the first planetary gear train G1 of the planetary gear transmission according to the seventh embodiment corresponds to FIG. 6C.

FIG. 25 shows a skeleton of a planetary gear transmission according to an eighth embodiment of the present invention. As shown in FIG. 25, the planetary gear transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other, and all of the first, second, and third planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1 for rotation therewith at all times, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. The elements of the planetary gear trains are coupled as shown in FIG. 25.

Since the ways of connecting each elements are clearly shown in figures (shelton figures), the minute description thereabout will not be provided hereinafter.

In the planetary gear transmission shown in FIG. 25, five forward and one reverse gear positions or ranges can be established by controlling engagement and disengagement of the first, second, and third clutches K1, K2, K3 and the first and second brakes B1, B2, in the same manner as shown in FIG. 20. In all of subsequent embodiments, the relationship between the ranges, engagement of the clutches and the brakes, and the speed reduction ratios is the same as the relationship shown in FIG. 20. FIG. 26 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the carrier C2 and the carrier C3 jointly serve as the second rotational member. The ring gear R2 and the ring gear R3 jointly serve as the third rotational member. The sun gear S2 serves as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 27 shows a skeleton of a planetary gear transmission according to a ninth embodiment of the present invention. The transmission shown in FIG. 27 differs from the transmission shown in FIG. 25 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 27 are identical to those of the transmission shown in FIG. 25. FIG. 28 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 27. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 29 shows a skeleton of a planetary gear

transmission according to a tenth embodiment. The transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 30 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the sun gear S2 and the sun gear S3 jointly serve as the second rotational member. The ring gear R2 serves as the third rotational member. The carrier C2 and ring gear R3 jointly serve as the fourth rotational member. The carrier C1 and the carrier C3 jointly serve as the fifth rotational member.

FIG. 31 shows a skeleton of a planetary gear transmission according to an eleventh embodiment. The transmission shown in FIG. 31 differs from the transmission shown in FIG. 29 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 31 are identical to those of the transmission shown in FIG. 29. FIG. 32 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 31. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 33 shows a skelton of a planetary gear transmission according to a 12th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 34 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the sun gear S2 and the carrier C3 jointly serve as the second rotational member. The ring gear R2 serves as the third rotational member. The carrier C2 and the ring gear R3 jointly serve as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 35 shows a skelton of a planetary gear transmission according to a 13th embodiment. The transmission shown in FIG. 35 differs from the transmission shown in FIG. 33 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 35 are identical to those of the transmission shown in FIG. 33. FIG. 36 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 35. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 37 shows a skelton of a planetary gear transmission according to a 14th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other. The first and second planetary gear trains G1, G2, comprise double-pinion planetary gear trains, and the third planetary gear train G3 comprises a single-pinion planetary gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 38 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the sun gear S2 and the ring gear R3 jointly serve as the second rotational member. The ring gear R2 and the carrier C3 jointly serve as the third rotational member. The carrier C2 serves as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 39 shows a skelton of a planetary gear transmission according to a 15th embodiment. The transmission shown in FIG. 39 differs from the transmission shown in FIG. 37 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 39 are identical to those of the transmission shown in FIG. 37. FIG. 40 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 39. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 41 shows a skelton of a planetary gear transmission according to a 16th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other. The first and second planetary gear trains G1, G2, comprise double-pinion planetary gear trains, and the third planetary gear

train G3 comprises a single-pinion planetary gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 42 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the carrier C2 and the ring gear R3 jointly serve as the second rotational member. The ring gear R2 and the carrier C3 jointly serve as the third rotational member. The sun gear S2 serves as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 43 shows a skelton of a planetary gear transmission according to a 17th embodiment. The transmission shown in FIG. 43 differs from the transmission shown in FIG. 41 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 43 are identical to those of the transmission shown in FIG. 41. FIG. 44 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 43. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 45 shows a skelton of a planetary gear transmission according to a 18h embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 46 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the sun gear S2 and the carrier C3 jointly serve as the second rotational member. The ring gear R2 and the ring gear R3 jointly serve as the third rotational member. The carrier C2 serves as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 47 shows a skelton of a planetary gear transmission according to a 19th embodiment. The transmission shown in FIG. 47 differs from the transmission shown in FIG. 45 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 47 are identical to those of the transmission shown in FIG. 45. FIG. 48 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 47. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 49 shows a skelton of a planetary gear transmission according to a 20th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 50 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the carrier C2 and the carrier C3 jointly serve as the second rotational member. The ring gear R2 and the ring gear R3 jointly serve as the third rotational member. The sun gear S2 serves as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 51 shows a skelton of a planetary gear transmission according to a 21st embodiment. The transmission shown in FIG. 35 differs from the transmission shown in FIG. 49 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 51 are identical to those of the transmission shown in FIG. 49. FIG. 52 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 51. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 53 shows a skelton of a planetary gear transmission according to a 22th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other. The fpirst and second planetary gear trains G1, G2, comprise double-pinion planetary gear trains, and the third planetary gear train G3 comprises a single-pinion planetary gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as

shown in FIG. 6D. FIG. 54 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1 and the sun gear S2 jointly serve as the second rotational member. The ring gear R2 and the ring gear R3 jointly serve as the third rotational member. The carrier C2 and the carrier C3 jointly serve as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 55 shows a skelton of a planetary gear transmission according to a 23th embodiment. The transmission shown in FIG. 55 differs from the transmission shown in FIG. 53 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 55 are identical to those of the transmission shown in FIG. 53. FIG. 56 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 55. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 57 shows a skelton of a planetary gear transmission according to a 24th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 58 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1 and the sun gear S2 jointly serve as the second rotational member. The ring gear R2 and the carrier C3 jointly serve as the third rotational member. The carrier C2 and the ring gear R3 jointly serve as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 59 shows a skelton of a planetary gear transmission according to a 25th embodiment. The transmission shown in FIG. 59 differs from the transmission shown in FIG. 57 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 59 are identical to those of the transmission shown in FIG. 57. FIG. 60 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 59. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 61 shows a skelton of a planetary gear transmission according to a 26th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other. The first and second planetary gear trains G1, G2, comprise double-pinion planetary gear trains, and the third planetary gear train G3 comprises a single-pinion planetary gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 62 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the sun gear S2 and the ring gear R3 jointly serve as the second rotational member. The ring gear R2 and the carrier C3 jointly serve as the third rotational member. The carrier C2 serves as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 63 shows a skelton of a planetary gear transmission according to a 27th embodiment. The transmission shown in FIG. 63 differs from the transmission shown in FIG. 61 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 63 are identical to those of the transmission shown in FIG. 61. FIG. 64 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 63. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 65 shows a skelton of a planetary gear transmission according to a 28th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other. The first and second planetary gear trains G1, G2, comprise double-pinion planetary gear trains, and the third planetary gear train G3 comprises a single-pinion planetary gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 66 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational

member. The ring gear R1, the carrier C2 and the ring gear R3 jointly serve as the second rotational member. The ring gear R2 and the carrier C3 jointly serve as the third rotational member. The sun gear S2 serves as the fourth rotational member. The carrier C1 and the sun gear S3 serve as the fifth rotational member.

FIG. 67 shows a skelton of a planetary gear transmission according to a 29th embodiment. The transmission shown in FIG. 67 differs from the transmission shown in FIG. 65 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 67 are identical to those of the transmission shown in FIG. 65. FIG. 68 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 67. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 69 shows a skelton of a planetary gear transmission according to a 30th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 70 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the sun gear S2 and the carrier C3 jointly serve as the second rotational member. The ring gear R2 and the ring gear R3 jointly serve as the third rotational member. The carrier C2 serves as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 71 shows a skelton of a planetary gear transmission according to a 31st embodiment. The transmission shown in FIG. 71 differs from the transmission shown in FIG. 69 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 71 are identical to those of the transmission shown in FIG. 69. FIG. 72 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 71. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 73 shows a skelton of a planetary gear transmission according to a 32nd embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 74 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the carrier C2 and the carrier C3 jointly serve as the second rotational member. The ring gear R2 and the ring gear R3 jointly serve as the third rotational member. The sun gear S2 serves as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 75 shows a skelton of a planetary gear transmission according to a 33rd embodiment. The transmission shown in FIG. 75 differs from the transmission shown in FIG. 73 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 75 are identical to those of the transmission shown in FIG. 73. FIG. 76 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 75. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 77 shows a skelton of a planetary gear transmission according to a 34th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 78 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the sun gear S2 and the sun gear S3 jointly serve as the second rotational member. The ring gear R2 serves as the third rotational member. The carrier C2 and the ring gear R3 jointly serve as the fourth rotational member. The carrier C1 and the carrier C3 jointly serve as the fifth rotational member.

FIG. 79 shows a skelton of a planetary gear

transmission according to a 35th embodiment. The transmission shown in FIG. 79 differs from the transmission shown in FIG. 77 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 79 are identical to those of the transmission shown in FIG. 77. FIG. 80 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 79. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 81 shows a skelton of a planetary gear transmission according to a 36th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 82 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1, the sun gear S2 and the carrier C3 jointly serve as the second rotational member. The ring gear R2 serves as the third rotational member. The carrier C2 and the ring gear R3 jointly serve as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 83 shows a skelton of a planetary gear transmission according to a 37th embodiment. The transmission shown in FIG. 83 differs from the transmission shown in FIG. 81 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 83 are identical to those of the transmission shown in FIG. 81. FIG. 84 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 83. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 85 shows a skelton of a planetary gear transmission according to a 38th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other. The first and second planetary gear trains G1, G2, comprise double-pinion planetary gear trains, and the third train G3 comprises a single-pinion planetary gear trains.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 86 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1 and the sun gear S2 jointly serve as the second rotational member. The ring gear R2 and the ring gear R3 jointly serve as the third rotational member. The carrier C2 and the carrier C3 jointly serve as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 87 shows a skelton of a planetary gear transmission according to a 39th embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 88 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R2 and the sun gear S2 jointly serve as the second rotational member. The ring gear R2 and the carrier C3 jointly serve as the third rotational member. The carrier C2 and the ring gear R3 jointly serve as the fourth rotational member. The carrier C1 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 89 shows a skelton of a planetary gear transmission according to a 40th embodiment. The transmission shown in FIG. 89 differs from the transmission shown in FIG. 87 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 89 are identical to those of the transmission shown in FIG. 87. FIG. 90 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 89. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 91 shows a skelton of a planetary gear transmission according to a 41st embodiment. The transmission has first, second, and third planetary gear trains G1,G2,G3 which are coaxially arranged parallel to each other. The first and third planetary gear trains G1, G3 comprise double-pinion planetary gear trains, and the second train G2 comprises a single-pinion gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securelyc connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 92 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1 and the ring gear R2 jointly serve as the second rotational member. The carrier C2 and the carrier C3 jointly serve as the third rotational member. The ring gear R3 serves the fourth rotational member. The carrier C1, the sun gear S2 and the sun gear S3 jointly serve as the fifth rotational member.

A planetary gear transmission according to a 42nd embodiment can comprise Ravigneaux gear train in the second and the third planetary gear trains G2,G3 as shown in FIG. 93. In this embodiment, a common sun gear S23 used in the trains G2, G3. A long pinion P_L and a short pinion P_S are disposed as shown, and are rotatably supported by a common carrier C23. Accordingly, in the embodiment, the second planetary gear train G2 comprises the common sun gear S23, the common carrier C23, the long pinion P_L and the second ring gear R2. The third planetary gear train G3 comprises the common sun gear S23, the common carrier C23, the long pinion P_L, the short pinion $P_S$and the third ring gear R3.

FIG. 94 shows a skelton of a planetary gear transmission according to a 43rd embodiment. The transmission shown in FIG. 94 differs from the transmission shown in FIG. 91 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 94 are identical to those of the transmission shown in FIG. 91. FIG. 95 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 94. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

A planetary gear transmission according to a 44th embodiment can also comprise Ravigneaux gear train in the second and the third planetary gear trains G2, G3 as shown in FIG. 96. In this embodiment, the second planetary gear train G2 comprises the common sun gear S23, the common carrier C23, the long pinion P_L and the second ring gear R2. The third planetary gear train G3 comprises the common sun gear S23, the common carrier C23, the long pinion P_L, the short pinion P_S and the third ring gear R3.

FIG. 97 shows a skeleton of a planetary gear transmission according to a 45th embodiment. The transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 98 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1 and the carrier C2 jointly serve as the second rotational member. The ring gear R2 and the carrier C3 jointly serve as the third rotational member. The ring gear R3 serves as the fourth rotational member. The carrier C1 , the sun gear S2 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 99 shows a skeleton of a planetary gear transmission according to a 46th embodiment. The transmission shown in FIG. 99 differs from the transmission shown in FIG. 97 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 99 are identical to those of the transmission shown in FIG. 97. FIG. 100 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 99. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 101 shows a skeleton of a planetary gear transmission according to a 47th embodiment. The transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other. The first and second planetary gear trains G1, G2, comprise double-pinion planetary gear trains, and the third train G3 comprises a single-pinion planetary gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 102 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves the first rotational member. The ring gear R1 and the sun gear S2 jointly serve as the second rotational member. The ring gear R3 serves as the third rotational member. The ring gear R2 and the carrier C3 jointly serve as the fourth rotational member. The carrier C1, the carrier C2 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 103 shows a skeleton of a planetary gear transmission according to a 48th embodiment. The

transmission shown in FIG. 103 differs from the transmission shown in FIG. 101 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 103 are identical to those of the transmission shown in FIG. 101. FIG. 104 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 103. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 105 shows a skeleton of a planetary gear transmission according to a 49th embodiment. The transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 106 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1 and the sun gear S2 jointly serve as the second rotational member. The carrier C3 serves as the third rotational member. The ring gear R2 and the ring gear R3 jointly serve as the fourth rotational member. The carrier C1, the carrier C2 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 107 shows a skeleton of a planetary gear transmission according to a 50th embodiment. The transmission shown in FIG. 107 differs from the transmission shown in FIG. 105 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 107 are identical to those of the transmission shown in FIG. 105. FIG. 108 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 107. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 109 shows a skeleton of a planetary gear transmission according to a 51st embodiment. The transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other. The first and second planetary gear trains G1, G2, comprise double-pinion planetary gear trains, and the third train G3 comprises a single-pinion planetary gear train.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 110 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1 and the carrier C2 jointly serve as the second rotational member. The ring gear R3 serves as the third rotational member. The ring gear R2 and the carrier C3 jointly serve as the fourth rotational member. The carrier C1, the sun gear S2 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 111 shows a skeleton of a planetary gear transmission according to a 52nd embodiment. The transmission shown in FIG. 111 differs from the transmission shown in FIG. 109 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 111 are identical to those of the transmission shown in FIG. 109. FIG. 112 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 111. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

FIG. 113 shows a skeleton of a planetary gear transmission according to a 53rd embodiment. The transmission has first, second, and third planetary gear trains G1, G2, G3 which are coaxially arranged parallel to each other, and all of the planetary gear trains G1, G2, G3 comprise double-pinion planetary gear trains, respectively.

The first sun gear S1 is nonrotatably fixed to a stationary member, and the first carrier C1 is securely connected to an input shaft 1, with the first planetary gear train G1 being of a structure as shown in FIG. 6D. FIG. 114 shows how the elements are coupled into first through fifth rotational members.

The sun gear S1 serves as the first rotational member. The ring gear R1 and the carrier C2 jointly serve as the second rotational member. The carrier C3 serves as the third rotational member. The ring gear R2 and the ring gear R3 serve as the fourth rotational member. The carrier C1, the sun gear S2 and the sun gear S3 jointly serve as the fifth rotational member.

FIG. 115 shows a skeleton of a planetary gear transmission according to a 54th embodiment. The transmission shown in FIG. 115 differs from the transmission shown in FIG. 113 only as to the first planetary gear train G1. Specifically, the first sun gear S1 is securely coupled to the input shaft 1, and the first carrier C1 is nonrotatably fixed to a stationary member. The other details of the transmission shown in FIG. 115 are identical to those of

the transmission shown in FIG. 113. FIG. 116 shows how the elements are coupled into first through fifth rotational members in the transmission shown in FIG. 115. The speed diagram of the first planetary gear train G1 corresponds to FIG. 6C.

Supplemental Description of the Embodiments

As described above, the first planetary gear train G1 comprises the first, second and fifth rotational members ① , ② and ⑤ . On the other hand, the second and third planetary gear train G2 and G3 comprise the second, third, fourth and fifth rotational members ② , ③ , ④ and ⑤ . The planetary gear transmissions according to the present invention can be represented by five combinations of the first-fifth rotational members as shown in Figs. 117, 119, 121, 123 and 125. In these figures, one of the three element (sun gear, carrier and ring gear) is respectively provided at the place where the symbol (O) is marked.

The combination as shown in Fig. 117 is divided into three types based on the position of clutch means K in a diagram as shown in Fig. 118. In the combination of Fig.117, the second planetary gear train G2 comprises the 2nd, 3rd and 4th rotational members ② , ③ and ④ , and the third planetary gear train G3 comprises the 2nd, 4th and 5th rotational members ② , ④ and ⑤ .

In the first type as shown in Fig. 118(A), a clutch means K is provided in the second rotational member ② and between the 2nd gear train G2 and the 3rd gear train G3. In the diagram, a brake B (shown by broken lines) can be provided either on the second gear train G2 or on the third gear train G3. The first type as shown in Fig. 118(A) comprises the transmissions of the 2nd embodiment (Fig.7), 3rd embodiment (Fig.11), 4th embodiment (Fig.13), 5th embodiment (Fig.17), 6th embodiment (Fig.19), 7th embodiment (Fig.23), 8th embodiment (Fig.25) and 9th embodiment (Fig.27).

In the second type as shown in Fig.118(B), a clutch means K is provided in the third rotational member ③ and between the 2nd gear train G2 and the 3rd gear train G3. The second type as shown in Fig. 118(B) comprises the transmissions of the 14th embodiment (Fig.37), 15th embodiment (Fig.39), 16th embodiment (Fig.41), 17th embodiment (Fig.43), 18th embodiment (Fig.45), 19th embodiment (Fig.47), 20th embodiment (Fig.49) and 21st embodiment (Fig.51).

In the third type as shown in Fig.118(C) a clutch K is provided in the fifth rotational member ⑤ and between the 1st gear train G1 and 2nd gear train G2. The third type as shown in Fig.118(C) comprises the transmissions of the 26th embodiment (Fig.61), 27th embodiment (Fig.63), 28th embodiment (Fig.65), 29th embodiment (Fig.67), 30th embodiment (Fig.69), 31st embodiment (Fig.71), 32nd embodiment (Fig.73) and 33rd embodiment (Fig.75).

The combination as shown in Fig.119 is divided into two types as shown in Fig.120 based on the position of clutch means K. In the combination of Fig.119, the second planetary gear train G2 comprises the 2nd, 3rd and 5th rotational members ② , ③ and ④ , and the third planetary gear train G3 comprises the 2nd, 4th and 5th rotational members ② , ④ and ⑤ .

In the first type as shown in Fig.120(A), a clutch K is provided in the fifth rotational member ⑤ and between the 1st gear train G1 and the third gear train G3. The first type as shown in Fig.120(A) comprises the transmissions of the 34th embodiment (Fig.77), 35th embodiment (Fig.79), 36th embodiment (Fig.81) and 37th embodiment (Fig.83).

In the second type as shown in Fig.120(B), a clutch K is provided in the second rotational member ② and between the 2nd gear train G2 and the 3rd gear train G3. In Fig.120(B), a brake B (shown by broken lines) can be provided either on the second gear train G2 or on the third gear train G3. The second type as shown in Fig.120(B) comprises the transmissions of the 10th embodiment (Fig.29), 11th embodiment (Fig.31), 12th embodiment (Fig.33) and 13th embodiment (Fig.35).

The combination as shown in Fig.121 is divided into two types as shown in Fig.122 based on the position of clutch K. In the combination of Fig.121, the second planetary gear train G2 comprises the 2nd, 3rd and 4th rotational members ② , ③ and ④ , and the third planetary gear train G3 comprises the 3rd, 4th and 5th rotational members ③ , ④ and ⑤ .

In the first type as shown in Fig.122(A), a clutch K is provided in the 5th rotational member ⑤ and between the first gear train G1 and the third gear train G3. The first type as shown in Fig.122(A) comprises the transmissions of the 1st embodiment (Fig.1), 38th embodiment (Fig.85), 39th embodiment (Fig.87) and 40th embodiment (Fig.89).

In the second type as shown in Fig.122(B), a clutch K is provided in the 3rd rotational member ③ and between the second gear train G2 and the third gear train G3. The second type as shown in Fig.122(B) comprises the transmissions of the 22nd embodiment (Fig.53), 23rd embodiment (Fig.55), 24th embodiment (Fig.57) and 25th embodiment (Fig.59).

The combination as shown in Fig.123 has one type of diagram as shown in Fig.124. In the combination of Fig.123, the second planetary gear train G2 comprises the 2nd, 3rd and 5th rotational members ② , ③ and ⑤ , and the third planetary gear train G3 comprises the 3rd, 4th and 5th rotational members ③ , ④ and ⑤ . The type as shown in

Fig.124 comprises the transmissions of the 41st embodiment (Fig.91), 42nd embodiment (Fig.93), 43rd embodiment (Fig.94), 44th embodiment (Fig.96) and 45th embodiment (Fig.97), 46th embodiment (Fig.99).

The combination as shown in Fig.125 has one type of diagram as shown in Fig.126. In the combination of Fig.125, the second planetary gear train G2 comprises the 2nd, 4th and 5th rotational members ② , ④ and ⑤ , and the third planetary gear train G3 comprises the 3rd, 4th and 5th rotational members ③ , ④ and ⑤ . The type as shown in Fig.126 comprises the transmissions of the 47th embodiment (Fig.101), 48th embodiment (Fig.103), 49th embodiment (Fig.105), 50th embodiment (Fig.107), 51st embodiment (Fig.109), 52nd embodiment (Fig.111), 53rd embodiment (Fig.113) and 54th embodiment (Fig.115).

Although certain preferred embodiments of the present invention has been shown and described in detail, it should be understood that various changes and modifications may be made therein without departing from the scope of the appended claims.

Claims

1. A planetary gear transmission comprising:

an input member;

first, second, and third planetary gear trains arranged coaxially with each other and each having elements including a sun gear, a carrier, and a ring gear, two of the elements of each of said first, second, and third planetary gear trains being directly or disengageably coupled to elements of the other planetary gear trains;

an output member;

three clutch means and two brake means for selectively establishing a power transmitting path from said input member to said output member through said first, second, and third planetary gear trains; and

at least one of said first, second, and third planetary gear trains comprising a double-pinion planetary gear train, one of said sun gear and said carrier of said double-pinion planetary gear train being coupled to said input member and the other of said sun gear and said carrier being nonrotatably fixed, said elements of the first, second, and third planetary gear trains being corotatably coupled into first, second, third, fourth, and fifth rotational members in a speed diagram, said third and fifth rotatable members being coupled to said input member, said fourth rotational member being coupled to said output member.

2. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1, G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

3. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G3 and the ring gear R3 of said second planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

4. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

5. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

6. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

7. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third

planetary gear train G3 jointly serving as said fifth rotational member.

8. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

9. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

10. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

11. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the carrier C3 of said third plan-

etary gear train G3 jointly serving as said fifth rotational member.

12. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the carrier C3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

13. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

14. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

15. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 jointly serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear

train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

16. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 jointly serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

17. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

18. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

19. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train and the carrier C3 of said planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 serving as said third rotational member;

the carrier C2 of said second planetary

gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

20. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train and the carrier C3 of said planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

21. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

22. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

23. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary

gear train G2 and the carrier C3 of said third planetary gear train G3 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

24. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

25. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

26. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

27. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third

planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train jointly serving as said fifth rotational member.

28. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train jointly serving as said fifth rotational member.

29. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

30. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

31. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serv-

ing as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

32. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

33. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

34. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the sun gear S2 of said second planetary gear train G2 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

35. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serv-

ing as said second rotational member;

the ring gear R2 of said second planetary gear train G2 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the carrier C3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

36. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the carrier C3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

37. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

38. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

39. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving

as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

40. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

41. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the carrier C2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

42. A planetary gear transmission according to claim 1, wherein said first and third planetary gear trains G1,G3 comprise double-pinion planetary gear trains, respectively, and said second planetary gear train G2 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the ring gear R2 of said second planetary gear train G2 jointly serving as said second rotational member;

the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

43. A planetary gear transmission according to claim 1, wherein said first planetary gear train G1 comprises a single-pinion planetary gear train and said second and third planetary gear train G2,G3 comprises a Ravigneaux planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary

gear train G1 and the ring gear R2 of said second planetary gear train G2 jointly serving as said second rotational member;

the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

44. A planetary gear transmission according to claim 1, wherein said first and third planetary gear trains G1,G3 comprise double-pinion planetary gear trains, respectively, and said second planetary gear train G2 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the ring gear R2 of said second planetary gear train G2 jointly serving as said second rotational member;

the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

45. A planetary gear transmission according to claim 1, wherein said first planetary gear train G1 comprises a single-pinion planetary gear train and said second and third planetary gear train G2,G3 comprises a Ravigneaux planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the Carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the ring gear R2 of said second planetary gear train G2 jointly serving as said second rotational member;

the carrier C2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

46. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the carrier C2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

47. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational mem-

ber;

the ring gear R1 of said first planetary gear train G1 and the carrier C2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said third rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

48. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said third rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

49. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said third rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

50. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the carrier C3 of said third planetary gear train G3 serving as said third rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

51. A planetary gear transmission according to claim 1, wherein said first, second, and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the sun gear S2 of said second planetary gear train G2 jointly serving as said second rotational member;

the carrier C3 of said third planetary gear train G3 serving as said third rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1, the carrier C2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

52. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the carrier C2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said third rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said fourth rotational member;
and

the carrier C1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

53. A planetary gear transmission according to claim 1, wherein said first and second planetary gear trains G1,G2 comprise double-pinion planetary gear trains, respectively, and said third planetary gear train G3 comprises a single-pinion planetary gear train;

the sun gear S1 of said first planetary gear train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the carrier C2 of said second planetary gear train G2 jointly serving as said second rotational member;

the ring gear R3 of said third planetary gear train G3 serving as said third rotational member;

the ring gear R2 of said second planetary gear train G2 and the carrier C3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

54. A planetary gear transmission according to claim 1, wherein said first, second and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the carrier C1 of said first planetary gear train G1 being coupled to said input member 1 and the sun gear S1 of said first planetary gear train G1 being nonrotatably fixed;

the sun gear S1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the carrier C2 of said second planetary gear train G2 jointly serving as said second rotational member;

the carrier C3 of said third planetary gear train G3 serving as said third rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the carrier C1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

55. A planetary gear transmission according to claim 1, wherein said first, second and third planetary gear trains G1,G2,G3 comprise double-pinion planetary gear trains, respectively;

the sun gear S1 of said first planetary gear

train G1 being coupled to said input member 1 and the carrier C1 of said first planetary gear train G1 being nonrotatably fixed;

the carrier C1 of said first planetary gear train G1 serving as said first rotational member;

the ring gear R1 of said first planetary gear train G1 and the carrier C2 of said second planetary gear train G2 jointly serving as said second rotational member;

the carrier C3 of said third planetary gear train G3 serving as said third rotational member;

the ring gear R2 of said second planetary gear train G2 and the ring gear R3 of said third planetary gear train G3 jointly serving as said fourth rotational member; and

the sun gear S1 of said first planetary gear train G1, the sun gear S2 of said second planetary gear train G2 and the sun gear S3 of said third planetary gear train G3 jointly serving as said fifth rotational member.

Fig. 1

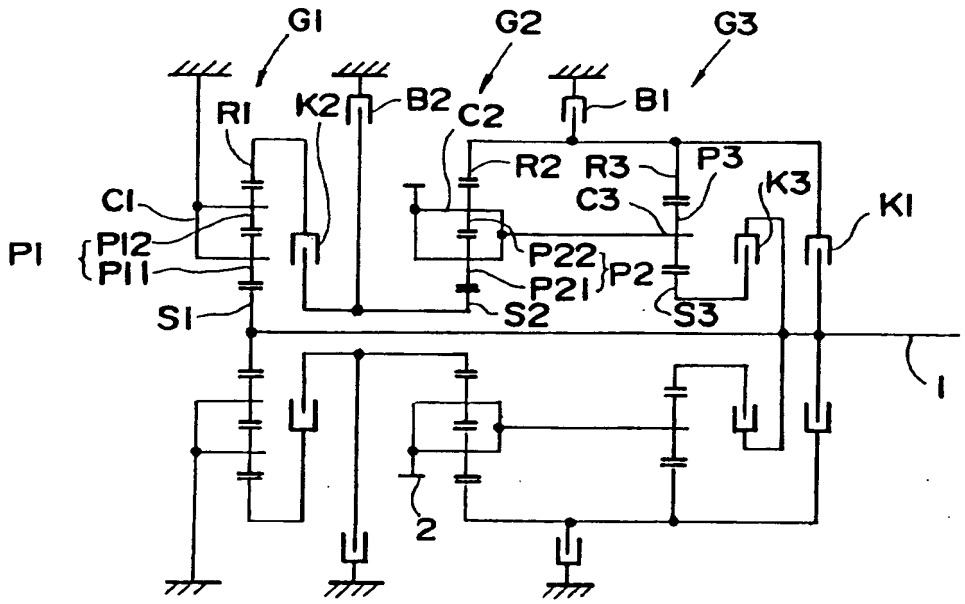


Fig. 2

RANGES	K 1	K 2	K 3	B 1	B 2	RATIOS
LOW			○	○		3. 577
2ND			○		○	2. 100
3RD		○	○			1. 400
4TH	○		○			1. 000
5TH	○	○				0. 711
REV		○		○		2. 953

Fig. 3

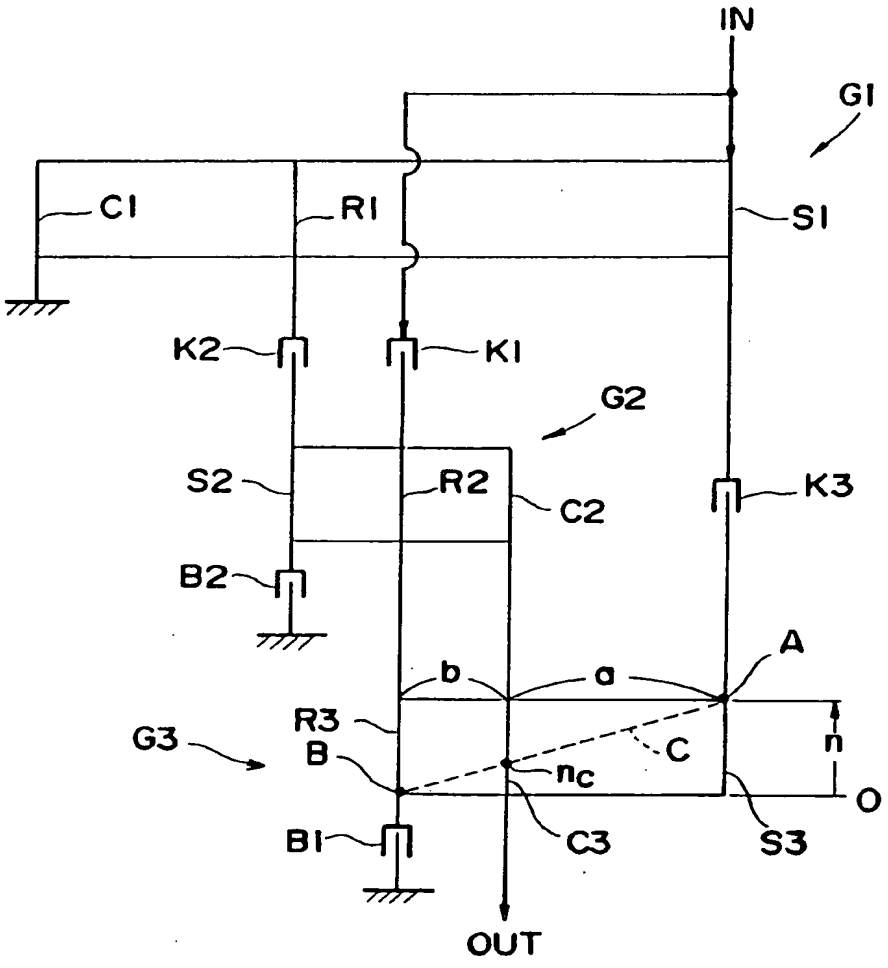


Fig. 4

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G 1	C1	R1			S1	0.45
	G 2		S2	R2	C2		0.43
	G 3			R3	C3	S3	0.39

Fig. 5

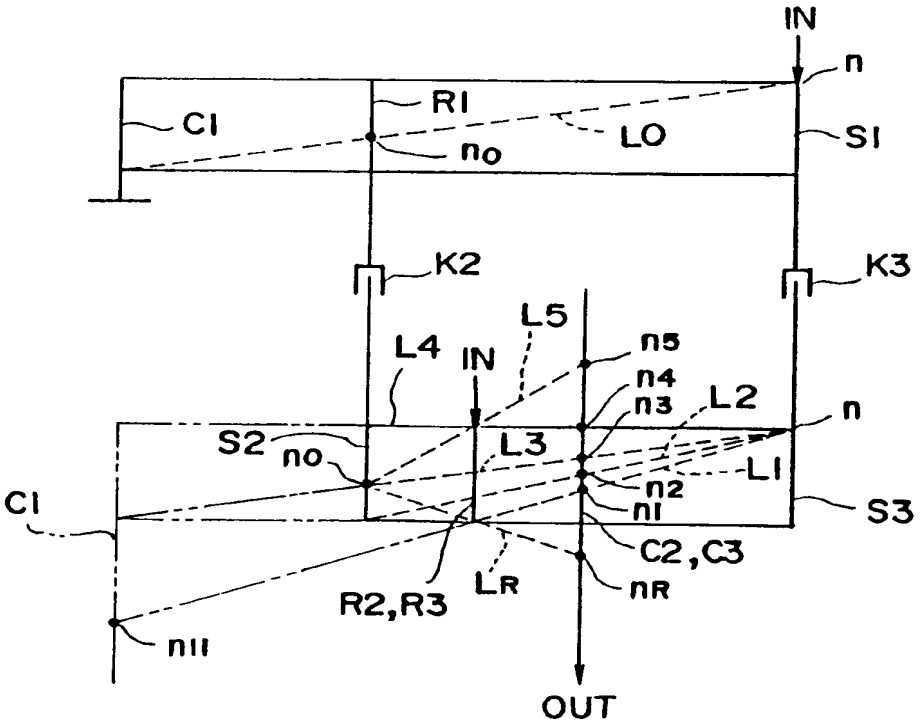


Fig.6A

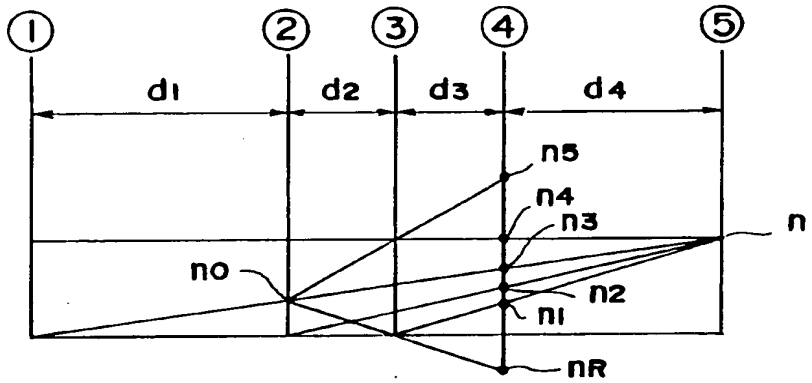


Fig.6B

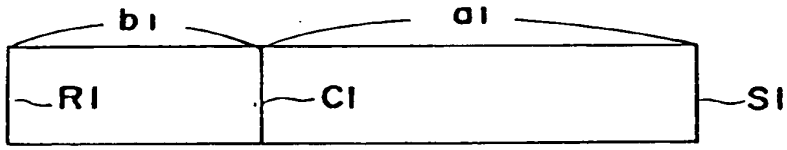


Fig.6C

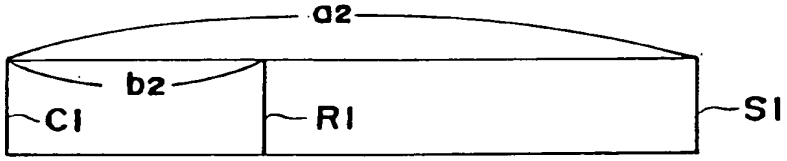


Fig.6D

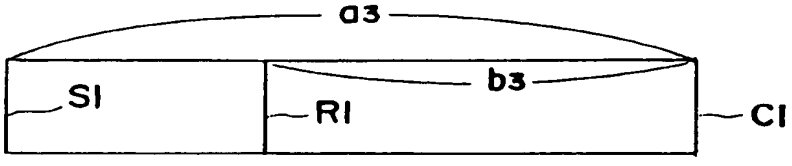


Fig. 7

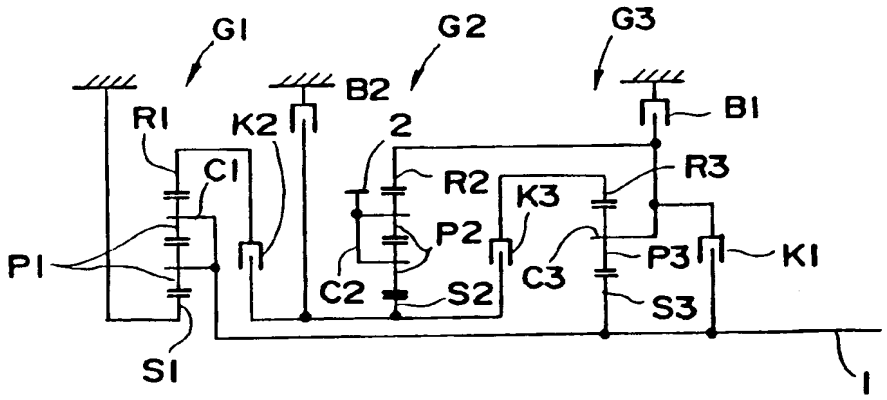


Fig. 8

RANGES	K 1	K 2	K 3	B 1	B 2	RATIOS
LOW			○	○		3. 577
2ND			○		○	2. 100
3RD		○	○			1. 400
4TH	○		○			1. 000
5TH	○	○				0. 711
REV		○		○		2. 953

Fig. 9

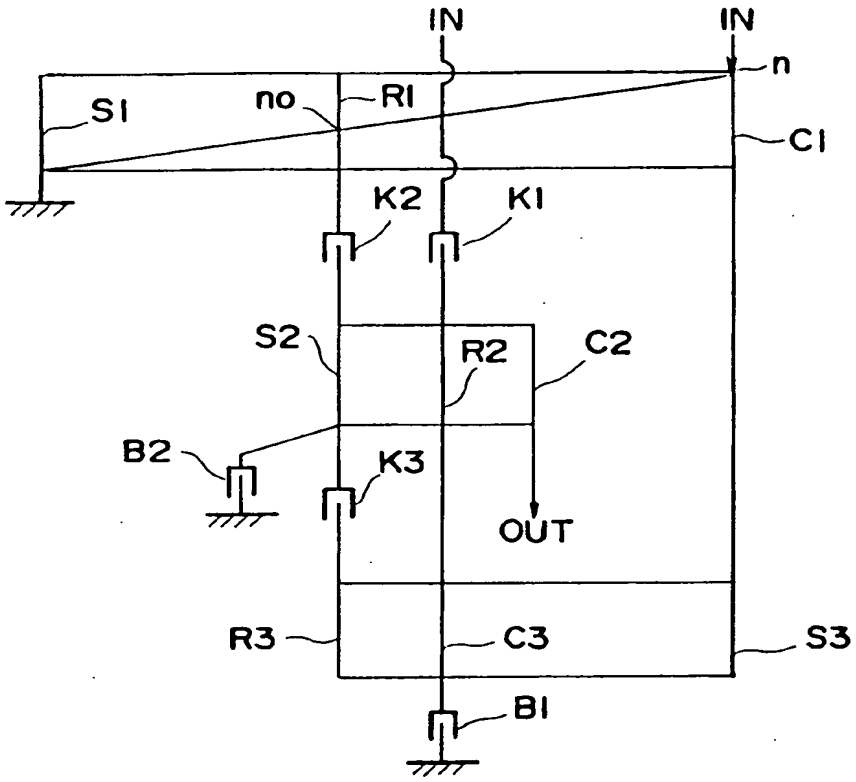


Fig. 10

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3		R3	C3		S3	0.38

Fig. 11

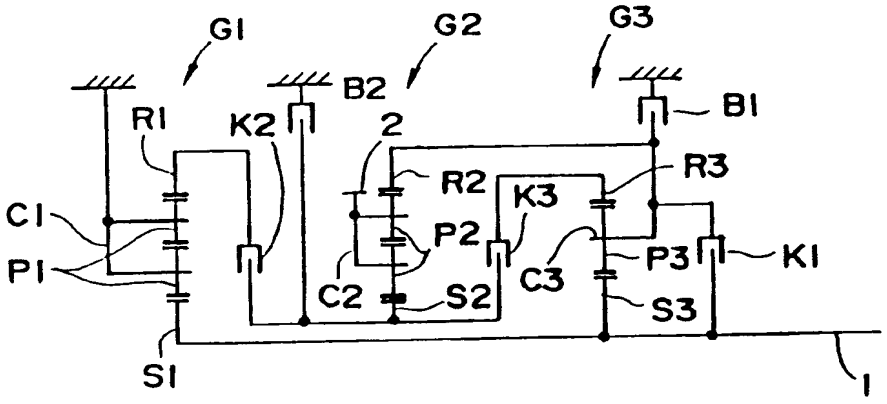


Fig. 12

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		R3	C3		S3	0.38

Fig.13

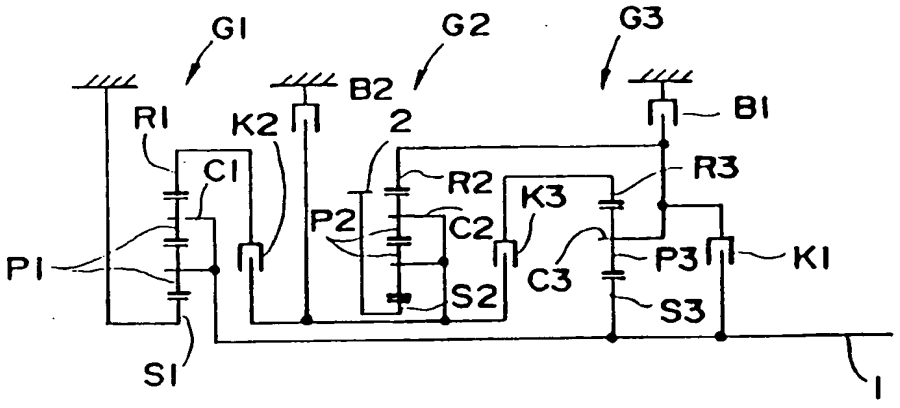


Fig.14

RANGES	K1	K2	K3	B1	B2	RATIOS
LOW			○	○		3.577
2ND			○		○	2.100
3RD		○	○			1.400
4TH	○		○			1.000
5TH	○	○				0.711
REV		○		○		2.953

Fig. 15

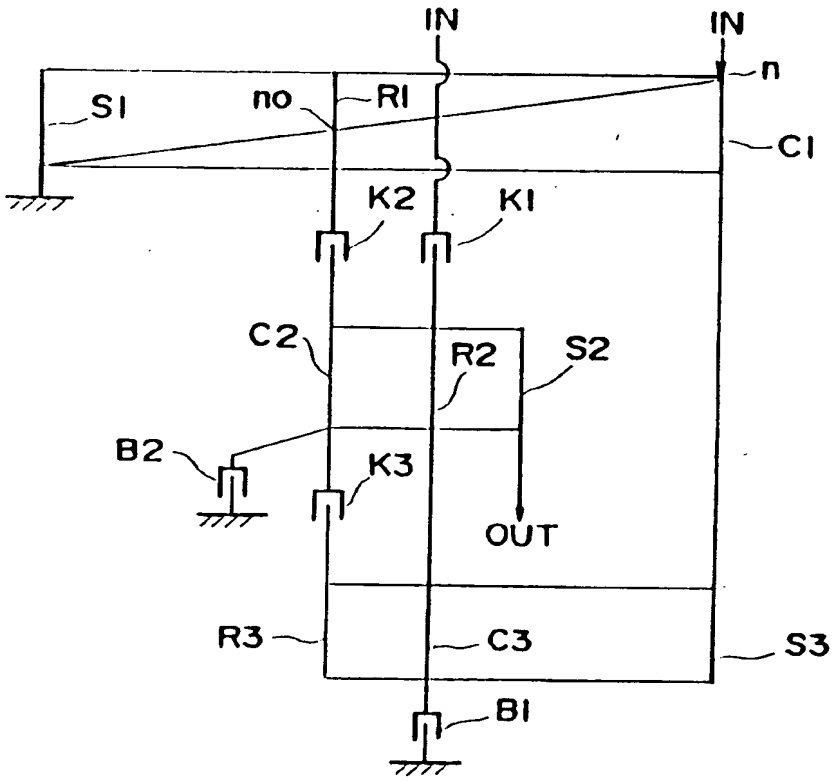


Fig. 16

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		C2	R2	S2		0.57
	G3		R3	C3		S3	0.37

Fig. 17

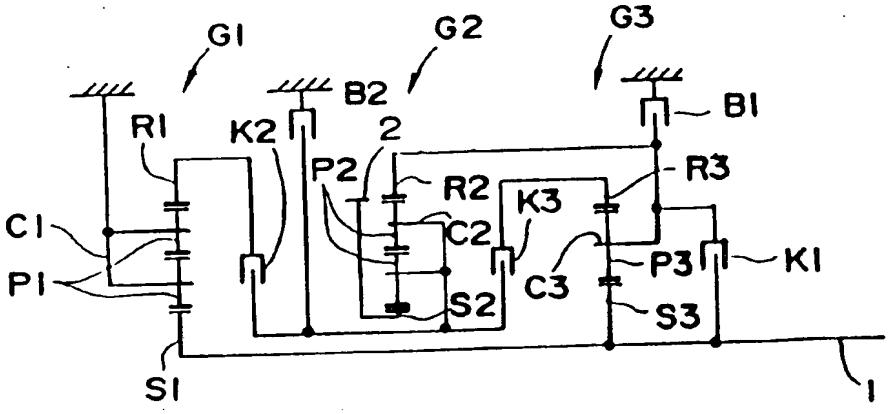


Fig. 18

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		C2	R2	S2		0.57
	G3		R3	C3		S3	0.37

Fig. 19

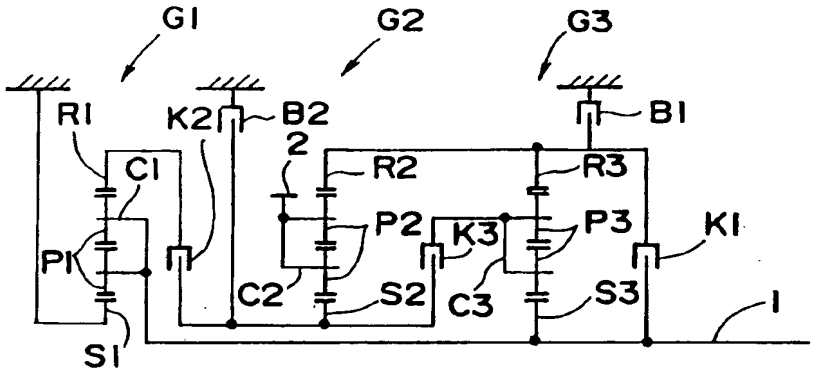


Fig. 20

RANGES	K 1	K 2	K 3	B 1	B 2	RATIOS
LOW			○	○		3. 577
2ND			○		○	2. 100
3RD		○	○			1. 400
4TH	○		○			1. 000
5TH	○	○				0. 711
REV		○		○		2. 953

Fig.21

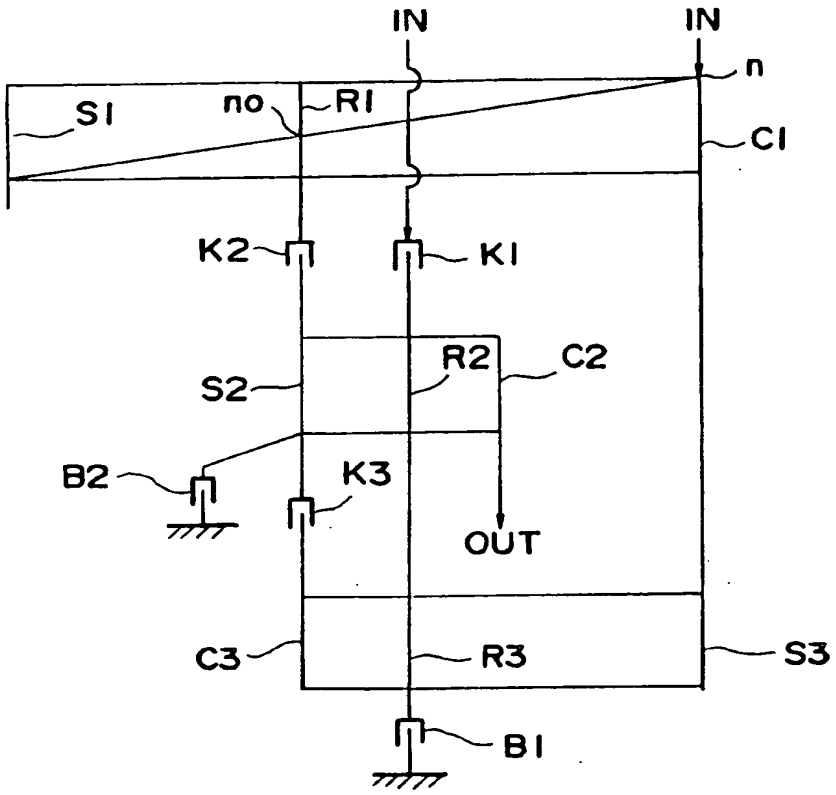


Fig.22

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3		C3	R3		S3	0.27

Fig.23

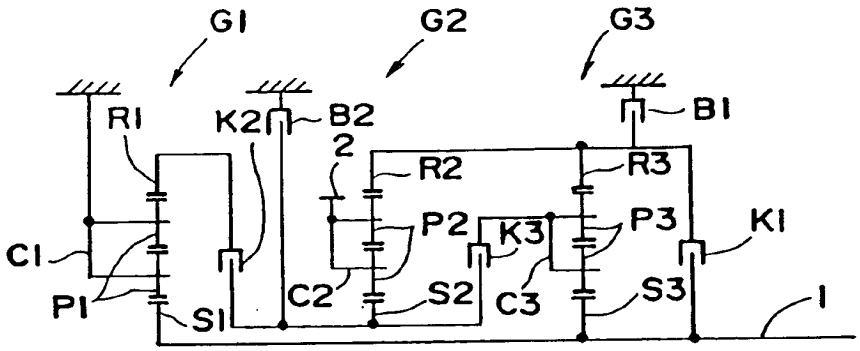


Fig.24

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		C3	R3		S3	0.27

Fig.25

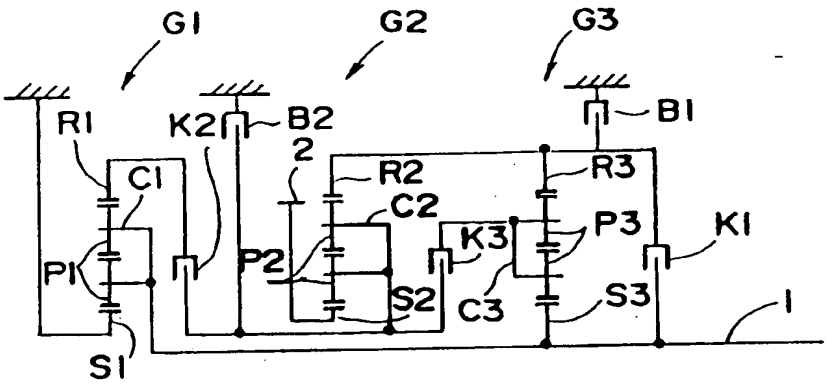


Fig.26

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		C2	R2	S2		0.57
	G3		C3	R3		S3	0.27

Fig. 27

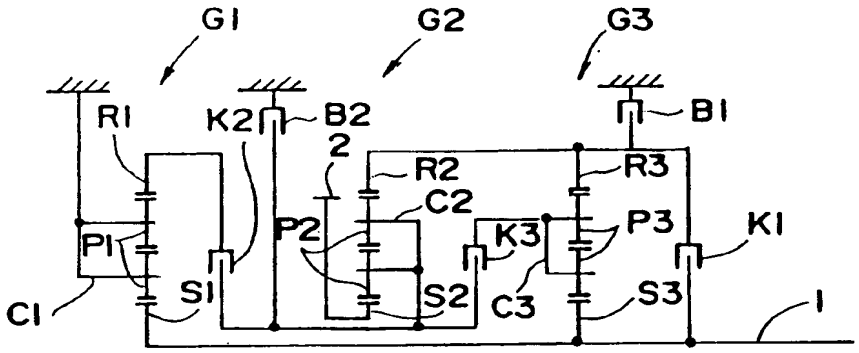


Fig. 28

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		C2	R2	S2		0.57
	G3		C3	R3		S3	0.27

Fig. 29

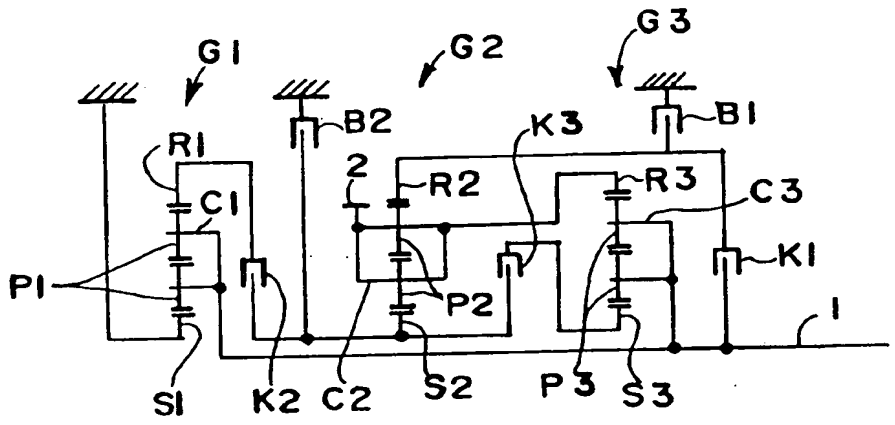


Fig. 30

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3		S3		R3	C3	0.52

Fig.31

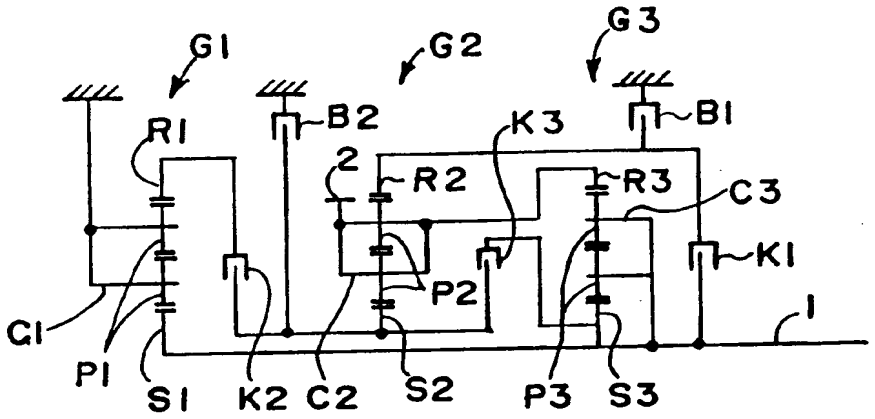


Fig.32

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		S3		R3	C3	0.52

Fig.33

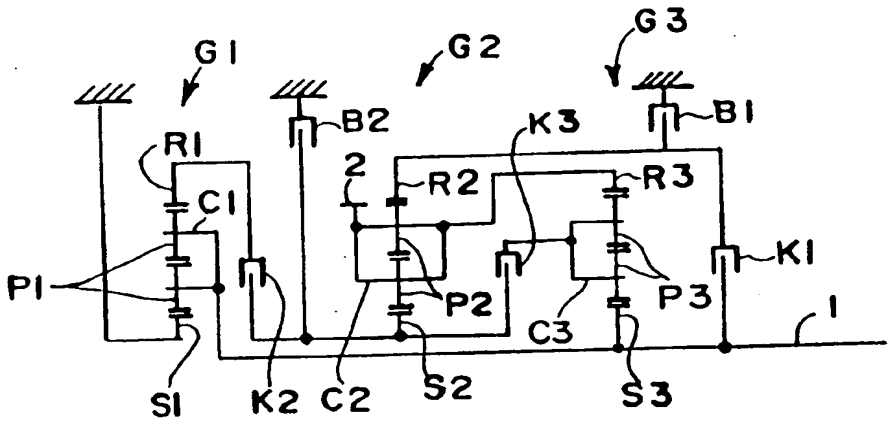


Fig.34

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3		C3		R3	S3	0.48

Fig.35

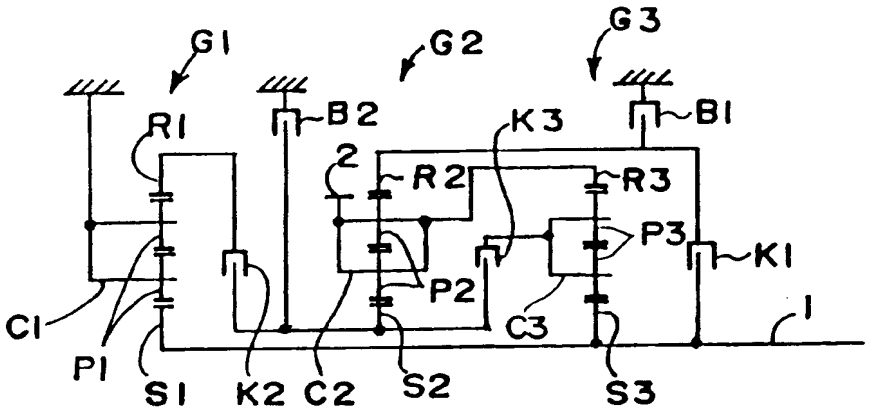


Fig.36

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		C3		R3	C3	0.48

Fig.37

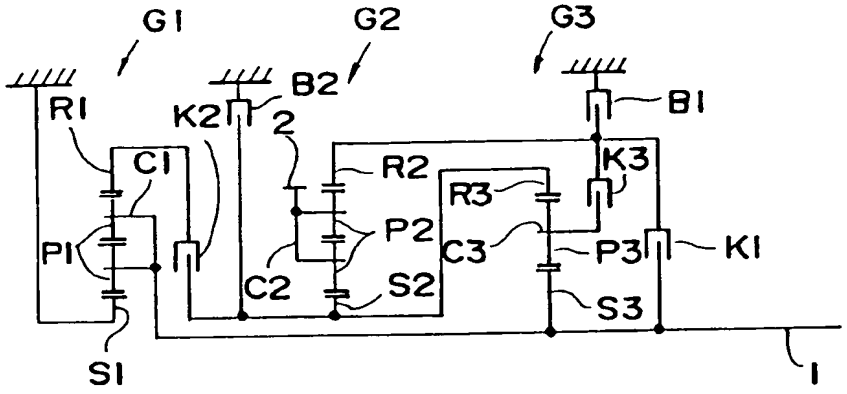


Fig.38

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3		R3	C3		S3	0.38

Fig.39

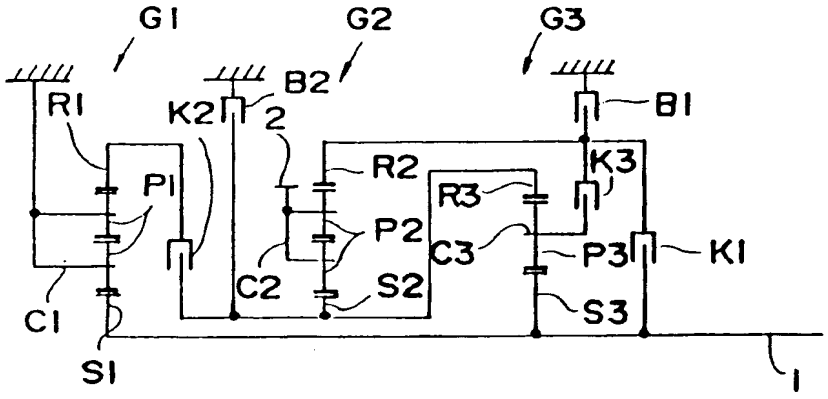


Fig.40

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		R3	C3		S3	0.38

Fig.41

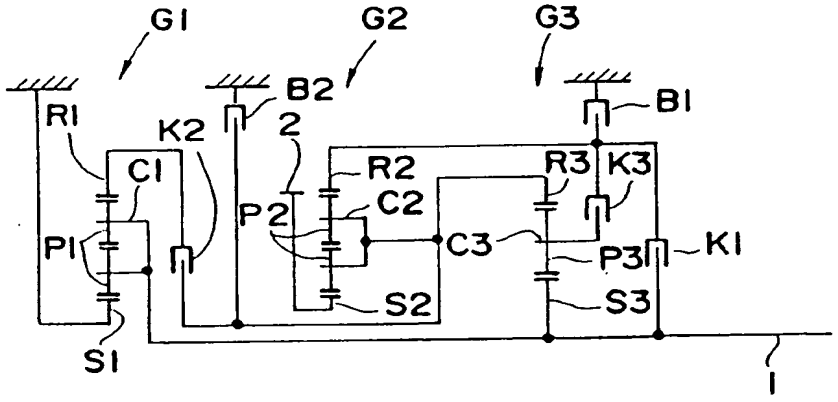


Fig.42

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		C2	R2	S2		0.57
	G3		R3	C3		S3	0.37

Fig. 43

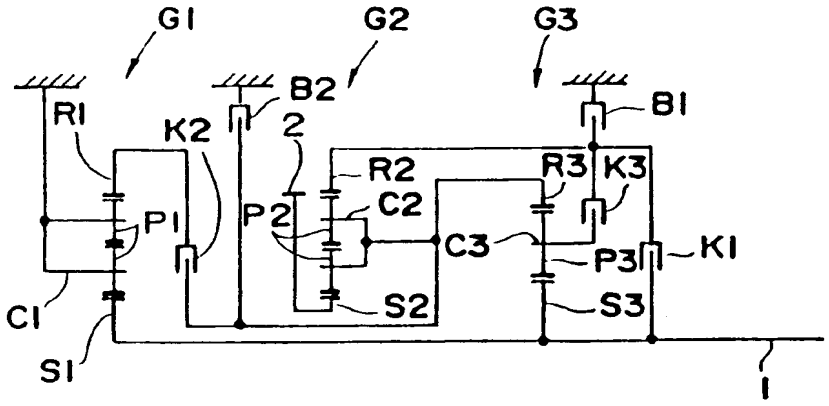


Fig. 44

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		C2	R2	S2		0.57
	G3		R3	C3		S3	0.37

Fig.45

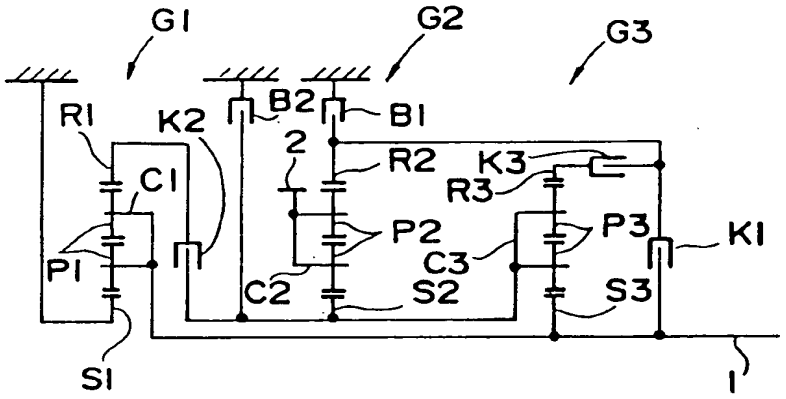


Fig.46

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3		C3	R3		S3	0.27

Fig. 47

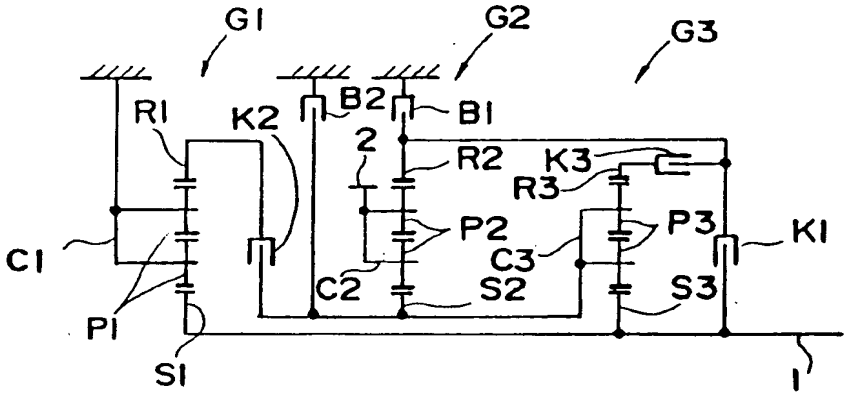


Fig. 48

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		C3	R3		S3	0.27

Fig. 49

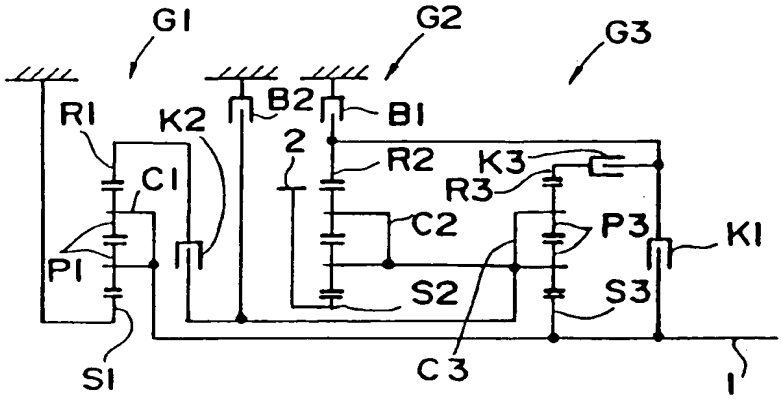


Fig. 50

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		C2	R2	S2		0.57
	G3		C3	R3		S3	0.27

Fig. 51

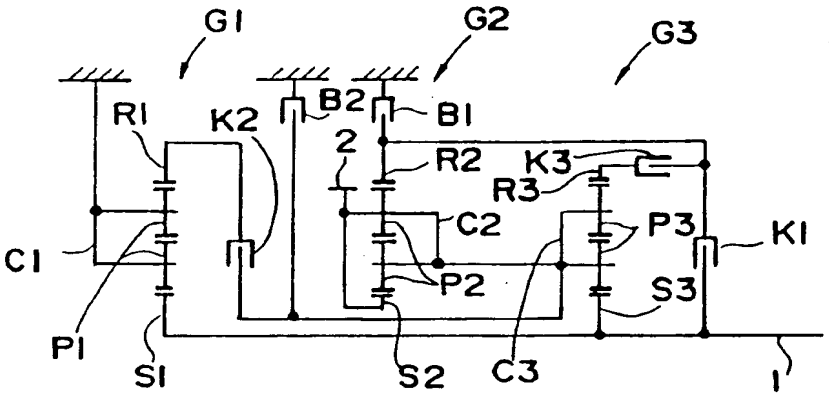


Fig. 52

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		C2	R2	S2		0.57
	G3		C3	R3		S3	0.27

Fig.53

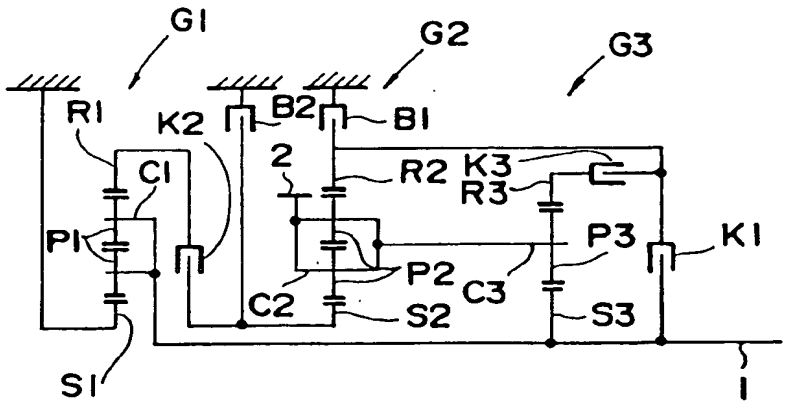


Fig.54

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3			R3	C3	S3	0.39

Fig.55

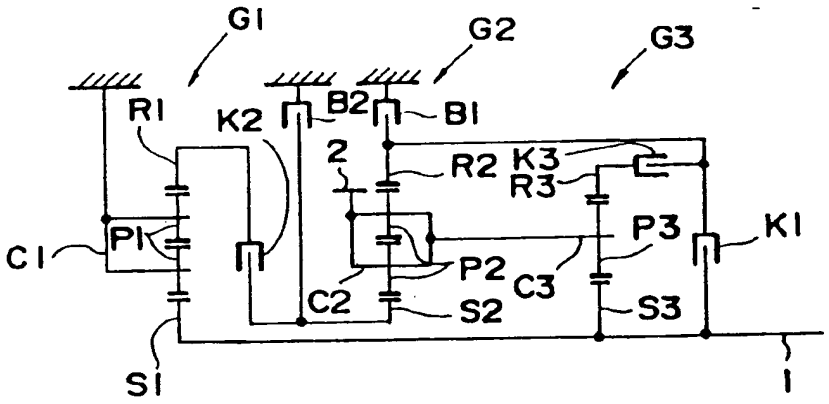


Fig.56

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3			R3	C3	S3	0.39

Fig. 57

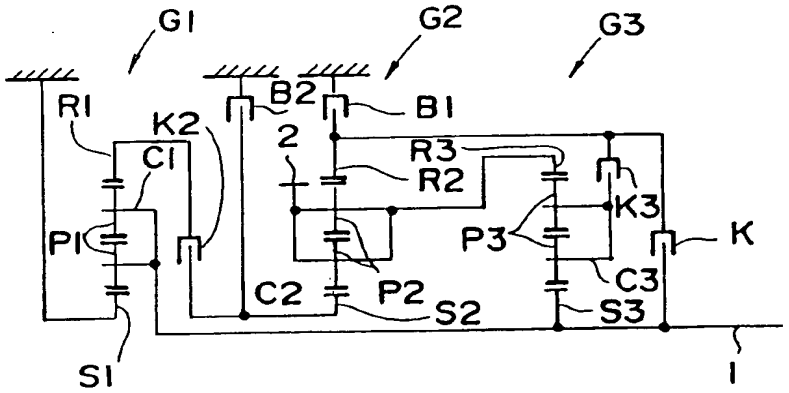


Fig. 58

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3			C3	R3	S3	0.28

Fig. 59

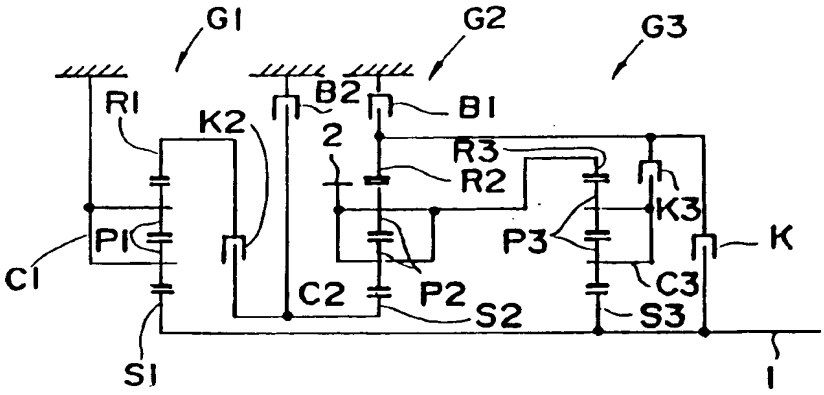


Fig. 60

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3			C3	R3	S3	0.28

Fig. 61

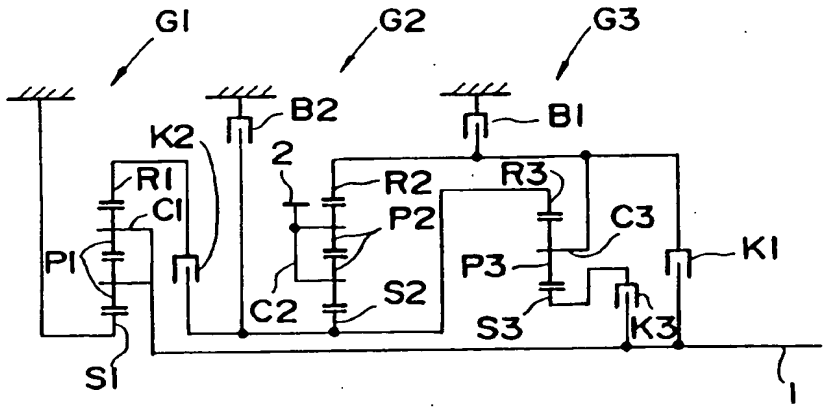


Fig. 62

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3		R3	C3		S3	0.38

Fig. 63

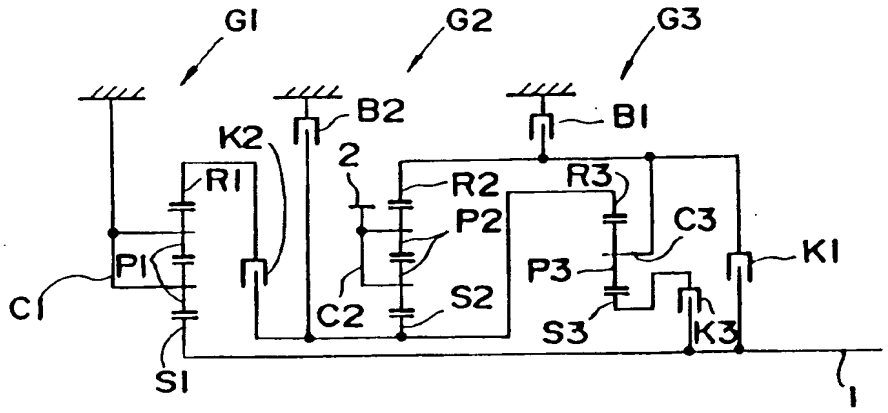


Fig. 64

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		R3	C3		S3	0.38

Fig. 65

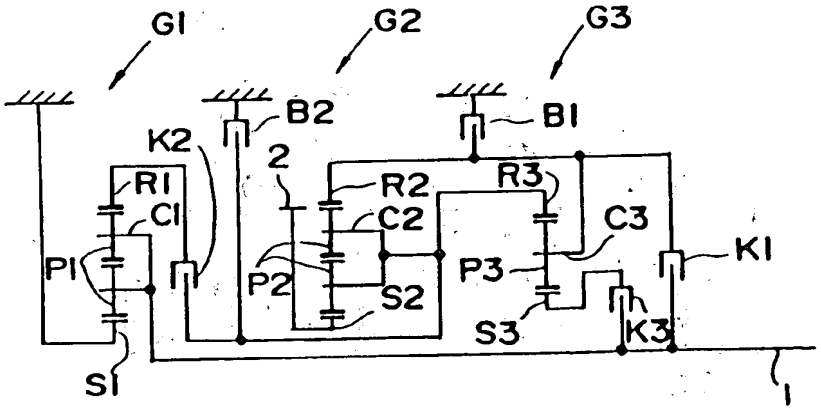


Fig.66

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		C2	R2	S2		0.57
	G3		R3	C3		S3	0.37

Fig. 71

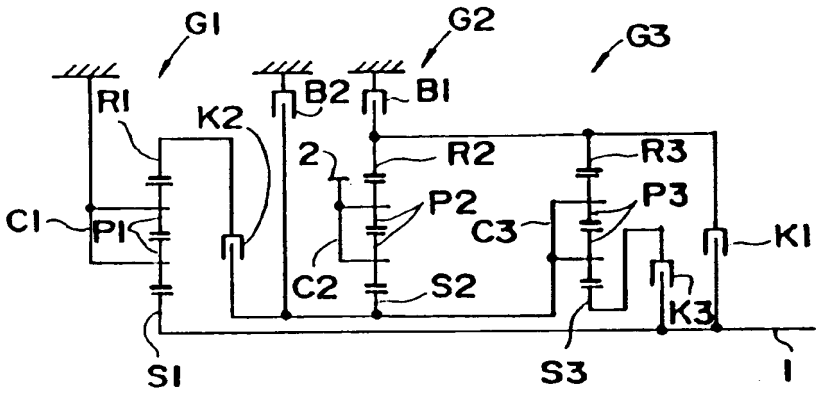


Fig. 72

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		C3	R3		S3	0.27

Fig. 73

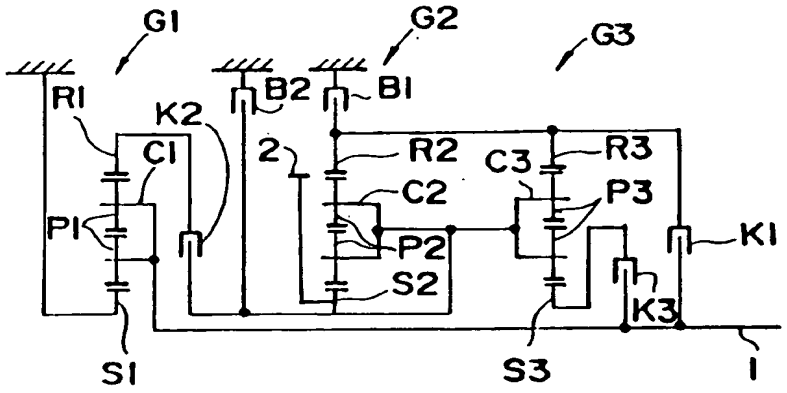


Fig. 74

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		C2	R2	S2		0.57
	G3		C3	R3		S3	0.27

Fig. 75

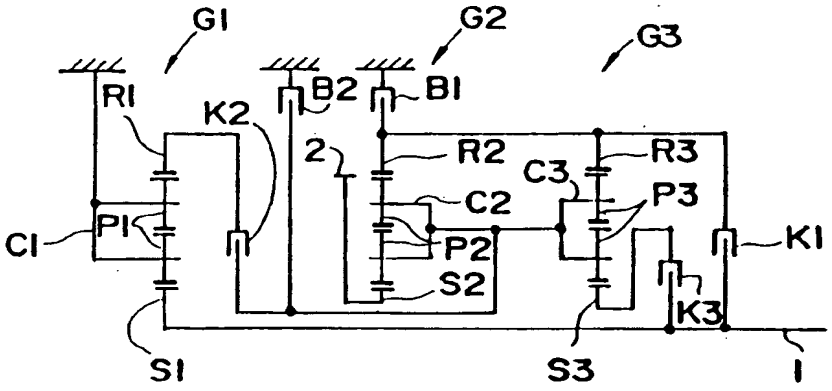


Fig. 76

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		C2	R2	S2		0.57
	G3		C3	R3		S3	0.27

Fig. 77

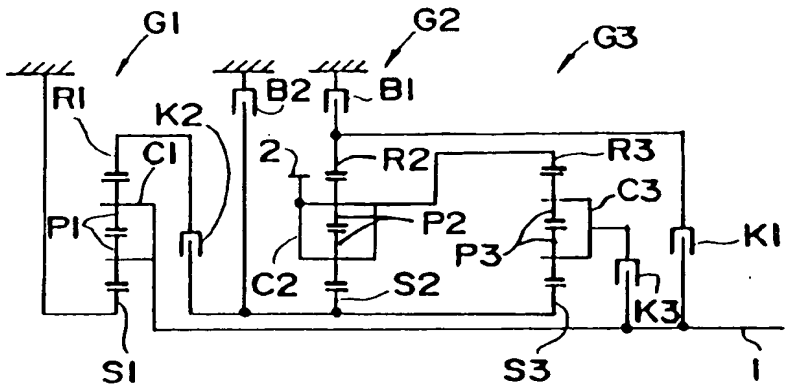


Fig. 78

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3		S3		R3	C3	0.52

Fig. 79

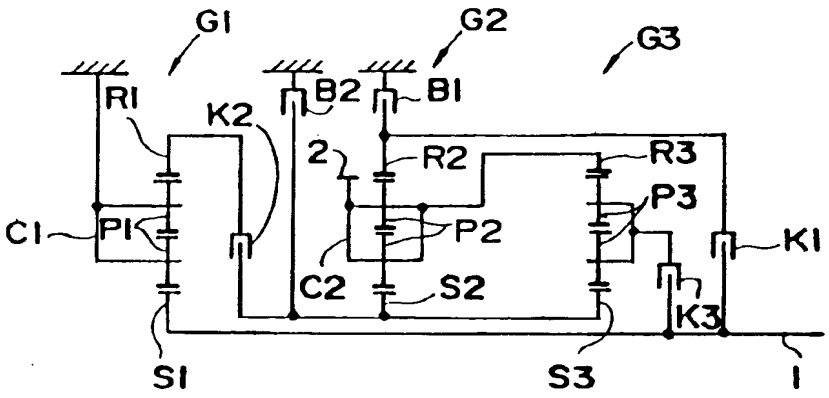


Fig. 80

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		S3		R3	C3	0.52

Fig. 81

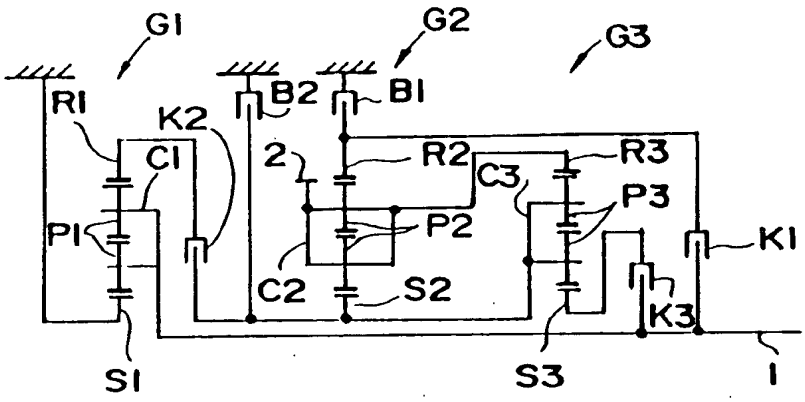


Fig. 82

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3		C3		R3	S3	0.48

Fig. 83

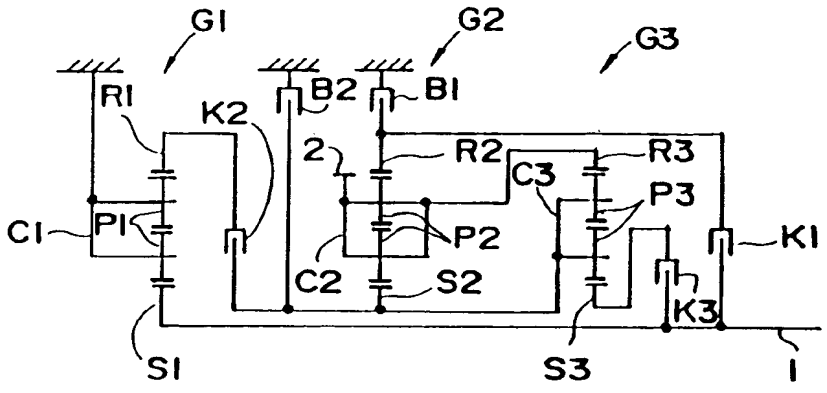


Fig. 84

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3		C3		R3	S3	0.48

Fig. 85

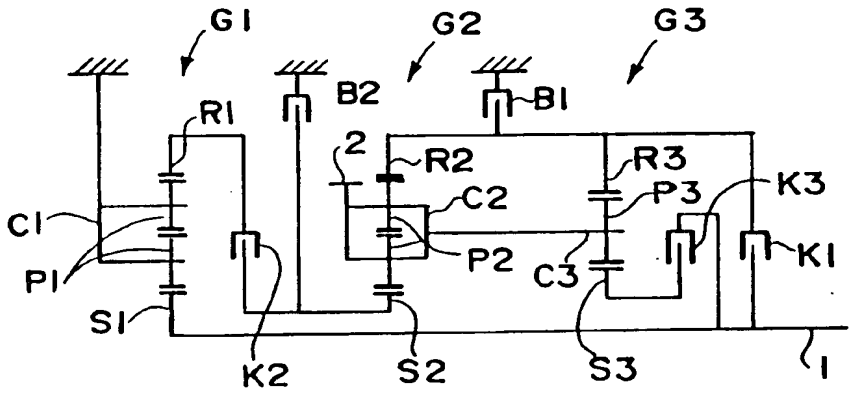


Fig. 86

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3			R3	C3	S3	0.39

Fig. 87

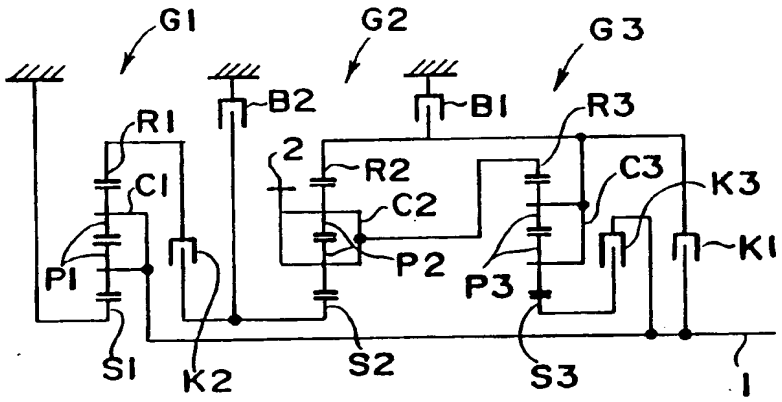


Fig. 88

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2	R2	C2		0.43
	G3			C3	R3	S3	0.28

Fig. 89

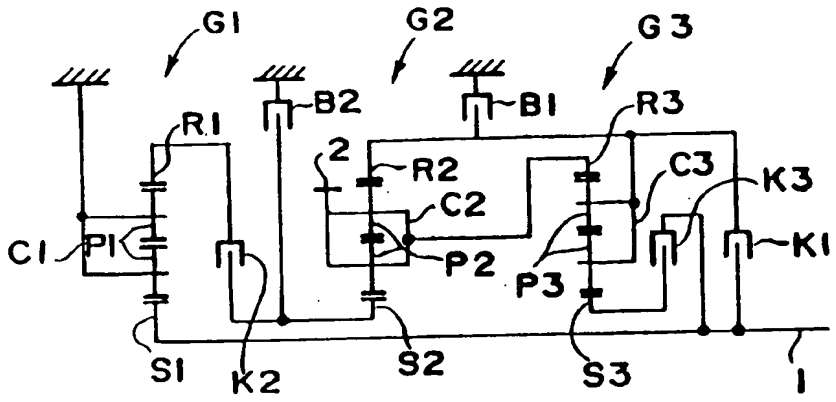


Fig. 90

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2	R2	C2		0.43
	G3			C3	R3	S3	0.28

Fig. 91

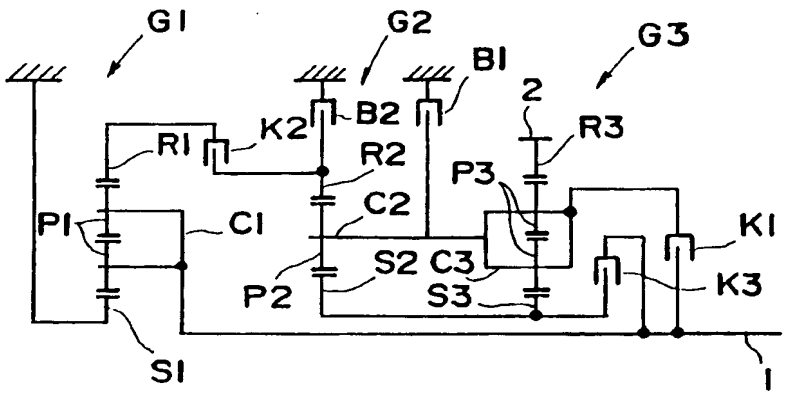


Fig. 92

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		R2	C2		S2	0.37
	G3			C3	R3	S3	0.28

Fig. 93

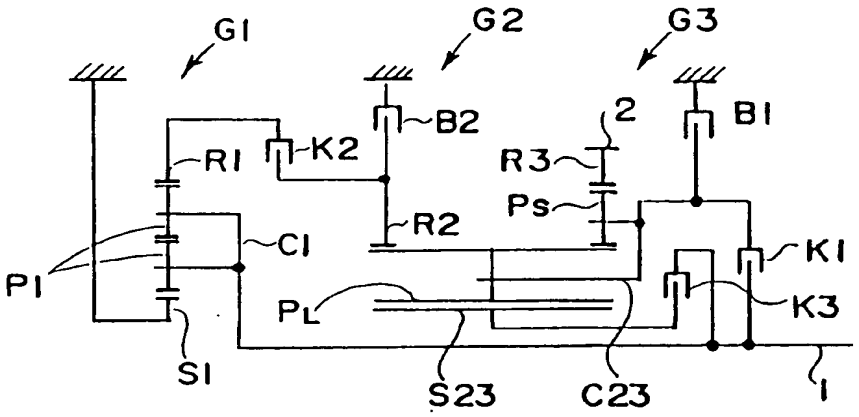

G1
G2
G3
B2
2
B1
R1
K2
R3
Ps
R2
C1
K1
P1
PL
K3
S1
S23
C23
I

Fig. 94

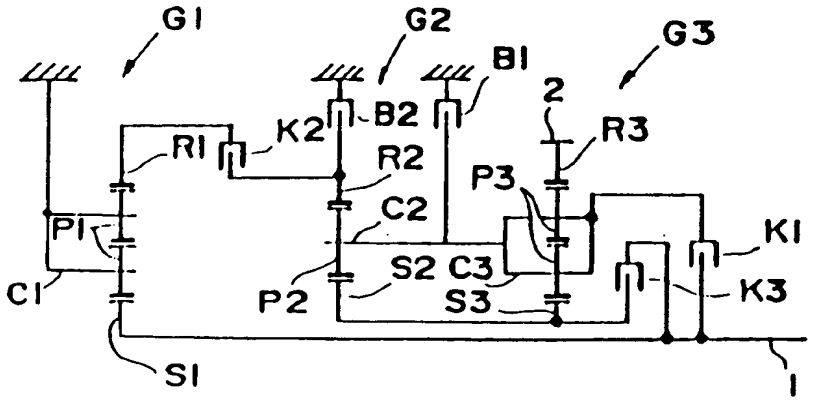

G1
G2
B1
G3
2
B2
K2
R3
R1
R2
P3
C2
P1
K1
S2
C3
C1
P2
S3
K3
S1
I

Fig. 95

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		R2	C2		S2	0.37
	G3			C3	R3	S3	0.28

Fig. 96

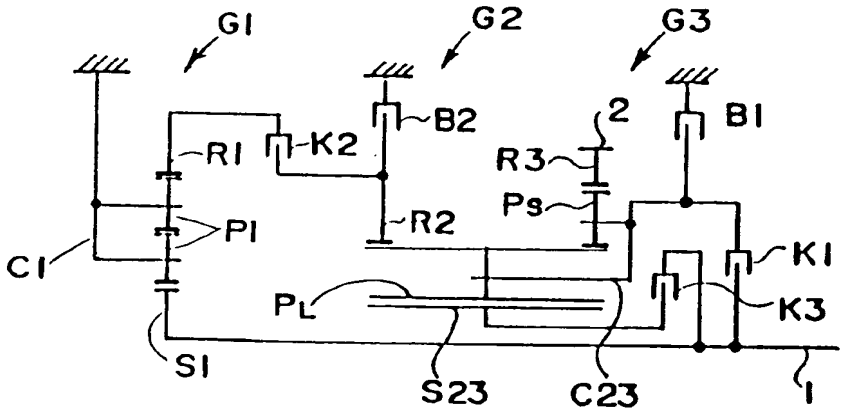


Fig. 97

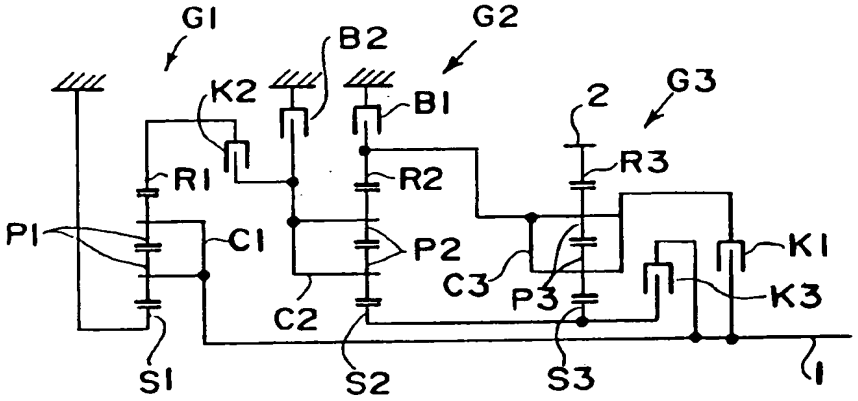


Fig. 98

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		C2	R2		S2	0.27
	G3			C3	R3	S3	0.27

Fig. 99

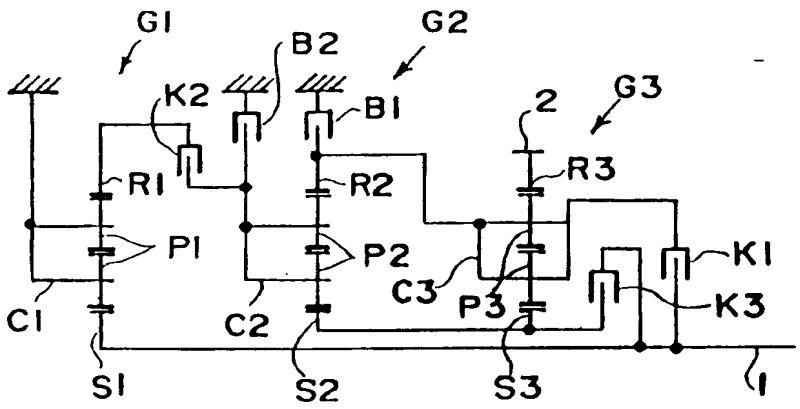


Fig. 100

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		C2	R2		S2	0.27
	G3			C3	R3	S3	0.27

Fig. 101

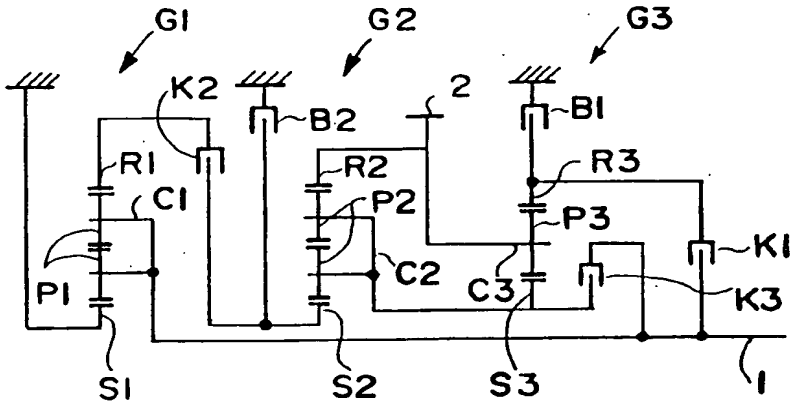


Fig. 102

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2		R2	C2	0.52
	G3			R3	C3	S3	0.39

Fig.103

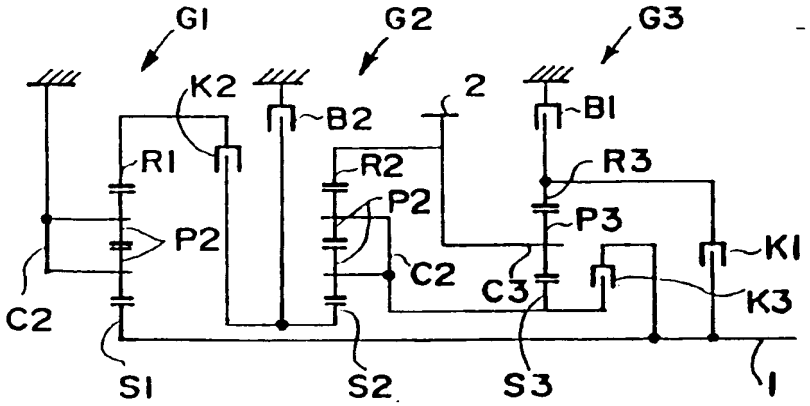


Fig.104

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2		R2	C2	0.52
	G3			R3	C3	S3	0.39

Fig. 105

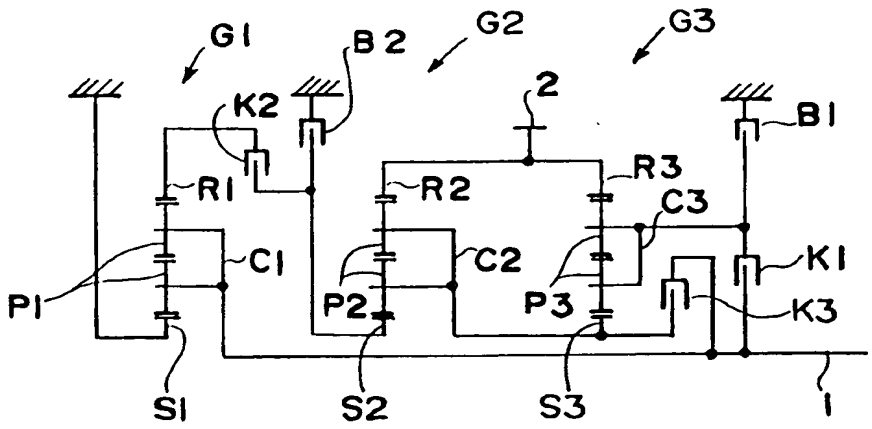


Fig. 106

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		S2		R2	C2	0.52
	G3			C3	R3	S3	0.28

Fig. 107

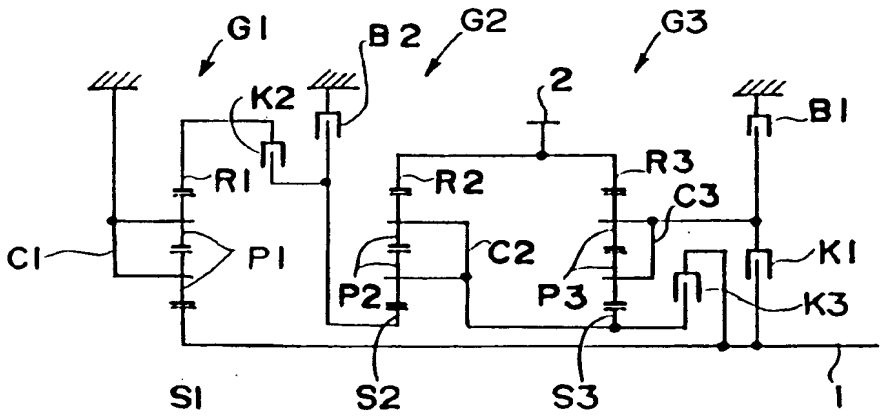


Fig. 108

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		S2		R2	C2	0.52
	G3			C3	R3	S3	0.28

Fig. 109

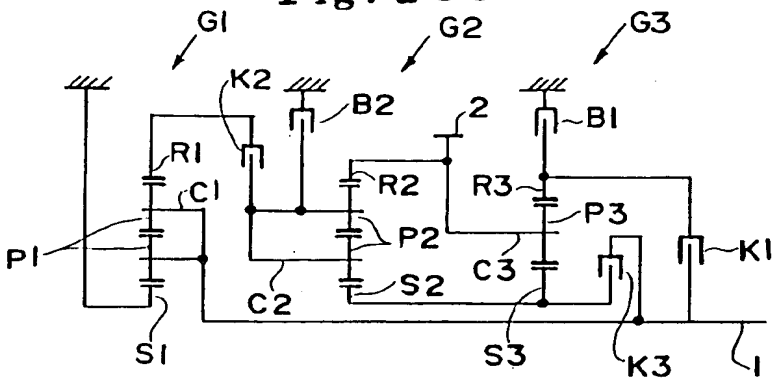


Fig. 110

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		C2		R2	S2	0.48
	G3			R3	C3	S3	0.39

Fig. 111

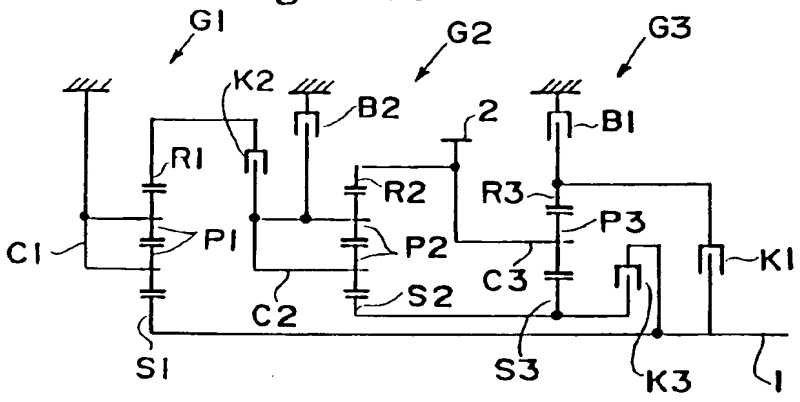


Fig. 112

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		C2		R2	S2	0.48
	G3			R3	C3	S3	0.39

Fig. 113

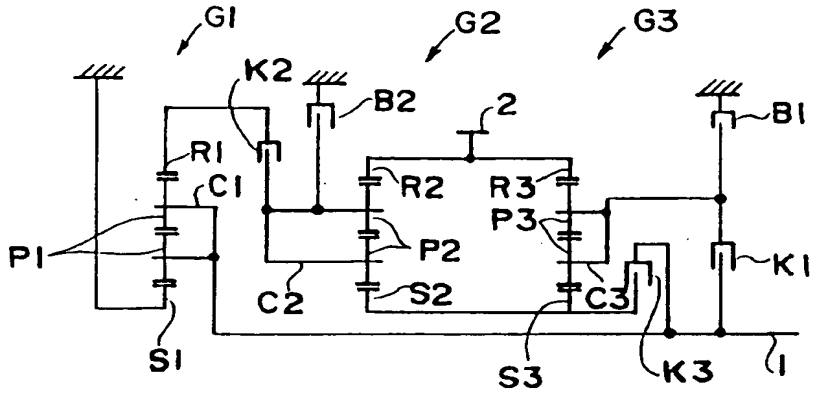


Fig. 114

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	S1	R1			C1	0.55
	G2		C2		R2	S2	0.48
	G3			C3	R3	S3	0.28

Fig. 115

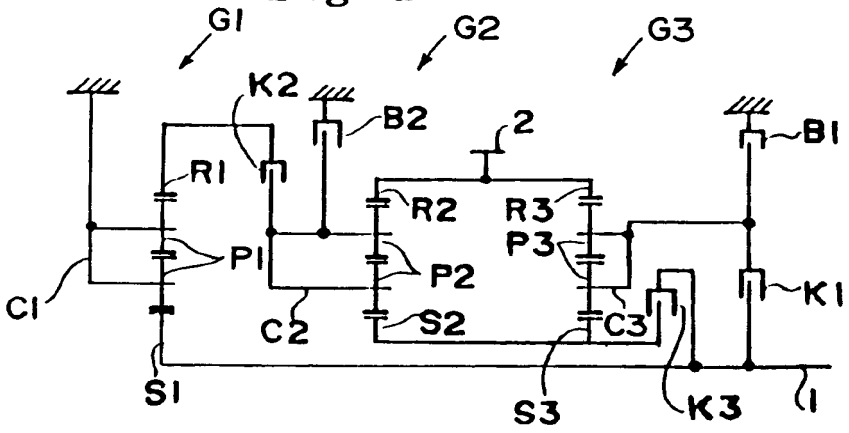


Fig. 116

		ROTATIONAL MEMBERS					
		1ST	2ND	3RD	4TH	5TH	λ
PLANETARY GEAR TRAINS	G1	C1	R1			S1	0.45
	G2		C2		R2	S2	0.48
	G3			C3	R3	S3	0.28

Fig. 117

		ROTATIONAL MEMBERS				
		1ST	2ND	3RD	4TH	5TH
PLANETARY GEAR TRAINS	G1	○	○			○
	G2		○	○	○	
	G3		○	○		○

Fig. 118

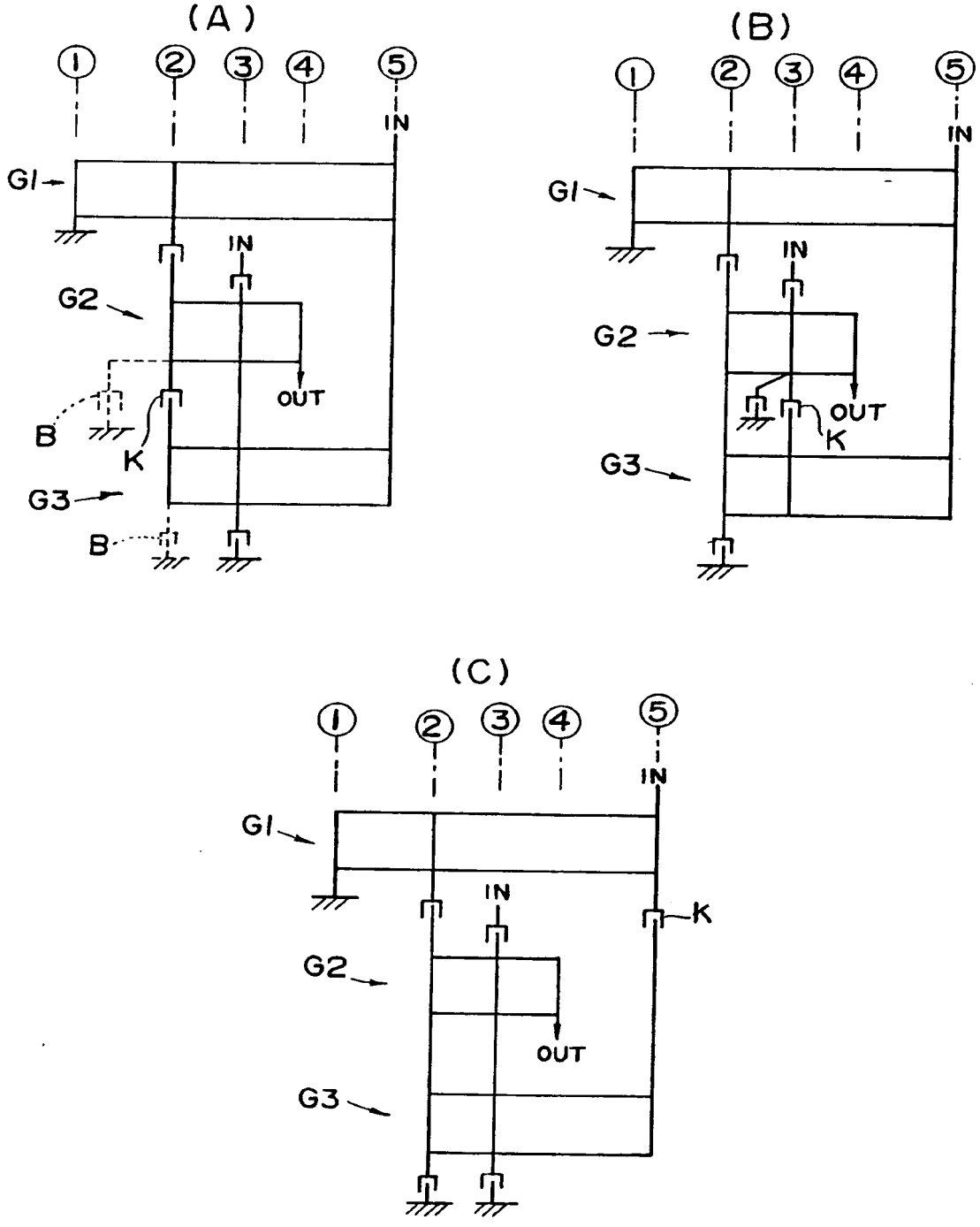

(A)
1
2
3
4
5
IN
G1
IN
G2
OUT
B
K
G3
B
(B)
1
2
3
4
5
IN
G1
IN
G2
OUT
K
G3
(C)
1
2
3
4
5
IN
G1
IN
K
G2
OUT
G3

Fig. 119

		ROTATIONAL MEMBERS				
		1ST	2ND	3RD	4TH	5TH
PLANETARY GEAR TRAINS	G1	○	○			○
	G2		○	○	○	
	G3		○		○	○

Fig. 120

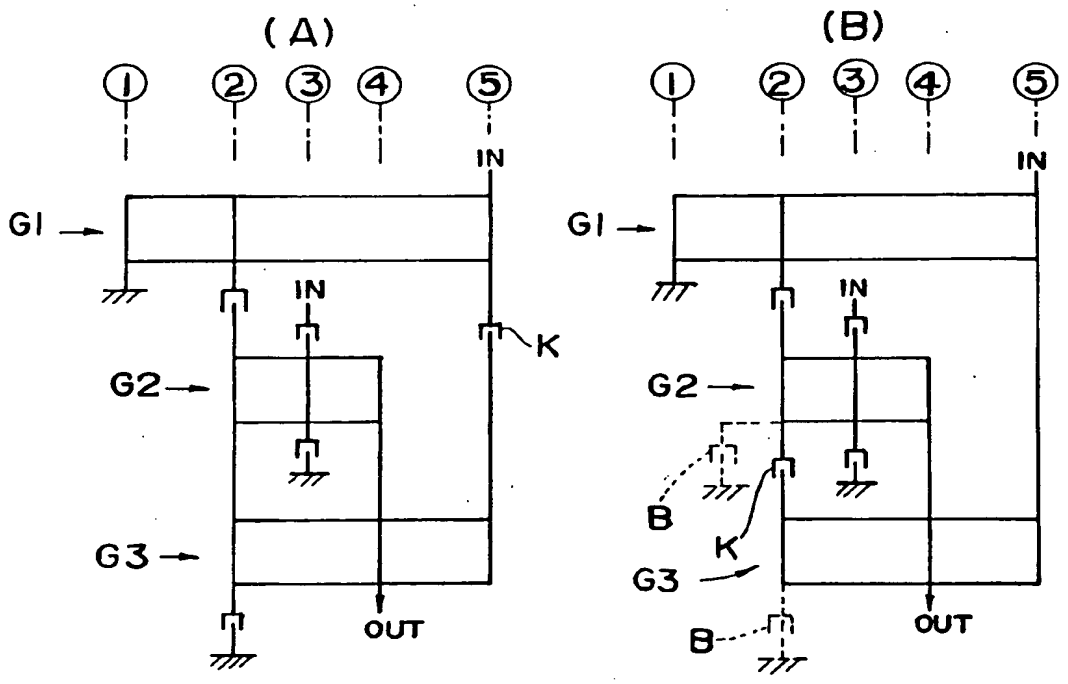


Fig. 121

		ROTATIONAL MEMBERS				
		1ST	2ND	3RD	4TH	5TH
PLANETARY GEAR TRAINS	G1	○	○			○
	G2		○	○	○	
	G3			○	○	○

Fig. 122

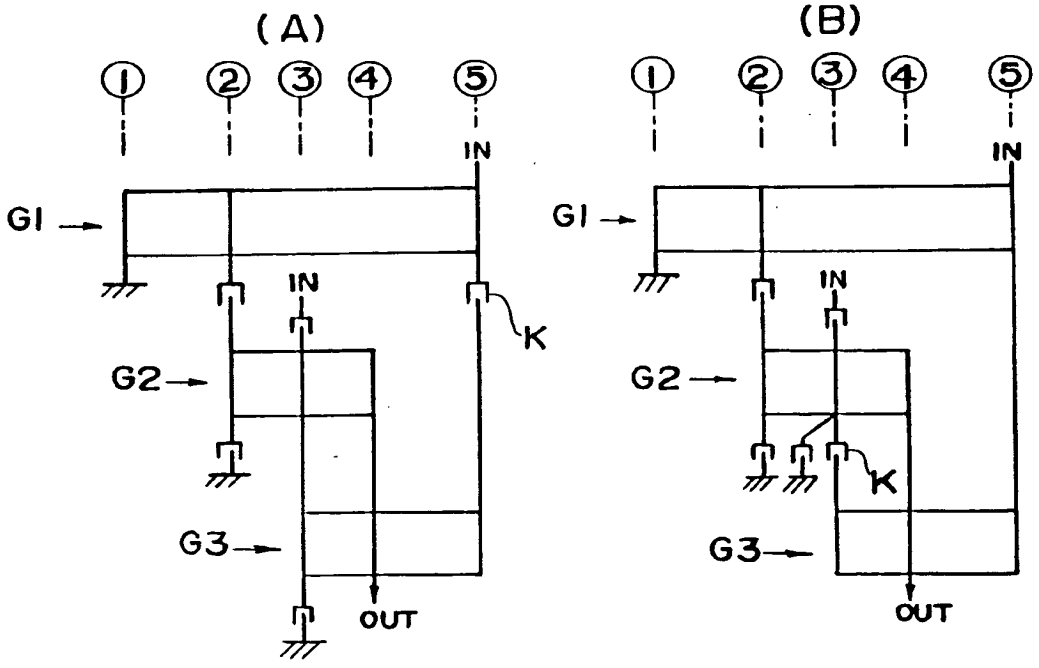


Fig. 123

		ROTATIONAL MEMBERS				
		1ST	2ND	3RD	4TH	5TH
PLANETARY GEAR TRAINS	G1	○	○			○
	G2		○	○		○
	G3			○	○	○

Fig. 124

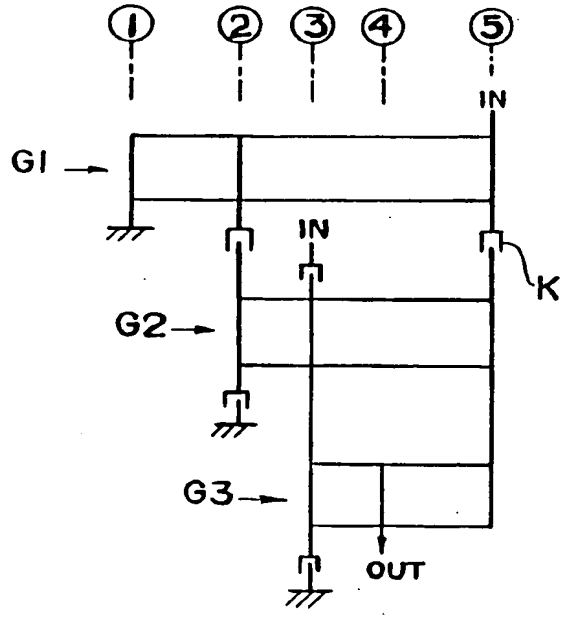
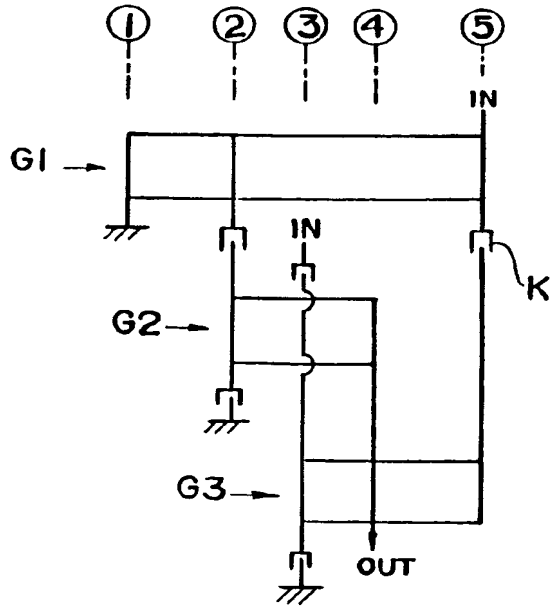


Fig. 125

		ROTATIONAL MEMBERS				
		1ST	2ND	3RD	4TH	5TH
PLANETARY GEAR TRAINS	G1	○	○			○
	G2		○		○	○
	G3			○	○	○

Fig. 126



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